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For Services Rendered

THE idea of service to the consumer is becoming widespread among those who deal with the general public. Sometimes that service is given on payment of a small fee, often it is free for a considerable period. It may be taken as obvious that engineering firms give to their clients much the same service. Engineers are sent to visit plants for some considerable time after installation in order to see that they are working properly and to correct any faults that may have developed. Work of this character is sound business, for repeat orders cannot be expected if plant does not give satisfaction, and often a fault develops due to some trifling cause that can be smoothed away by the touch of the expert hand. It is, moreover, a way of "keeping in touch" with the potential client, and is thus part of the sales organisation. The complaint often heard among chemical plant makers is not that they are asked to give this service, but that they frequently never learn what has been the behaviour of their plant, once it has been installed.

If service after delivery is plain sailing, it is very different with service before the placing of the order; it is one of the greatest problems that can face any manufacturer how far he should spend money in the hope of getting an order. We heard of an experience recently which illustrates this difficulty. It was desired to ascertain whether a certain natural product could be treated by a patented process. Obviously, it would be impossible for a proper opinion to be given by anyone not intimately connected with the process, for it was highly specialised. Samples were sent to the laboratory of the patentee, and after an analysis that would take one chemist perhaps a couple of days a report was issued showing in a few words the results that would be expected. The report was accompanied by an intimation that the fee for the work would be £10 per sample. Is it likely that a client would continue to send samples to be tested by this process, when those who handle competitive processes would report on the suitability of their systems without charge? A sense of proportion must be preserved. One of the first expenses that every constructional firm is prepared to face as a matter of course is that of estimating and preparing tenders. It is never suggested that a charge should be made for doing this. The estimating department is regarded as part of the normal establishment, and its cost comes under the "overheads." No one will buy unless he knows the price, and no one will buy unless he knows the article to be suited to his needs. It would seem to be elementary common sense for the expenses of running the laboratory to be equally regarded as "overheads."

It is, however, quite another matter when the work

required is more than the normal, skilled and intelligent laboratory procedure. The first question to be asked is whether or not the work done is likely to lead to an order, and whether the order would be of such proportions and at such prices as to be worth while. Human nature comes into play, and all too often the unwary firm that undertakes development work of this character finds that much expense has been incurred and much time wasted only for the client to reply that (having cleared up the points wherein he was in doubt) he will "issue a specification" presently, to which several firms will be invited to quote. The order then goes to someone who has done no work towards the development of the process, and at "plate-work" prices. This procedure would not be followed, of course, under normal circumstances by a reputable firm, but circumstances sometimes are not normal in that the constructional firm, thinking its position is secure, may attempt to charge fancy prices, thus compelling the client to go elsewhere. The whole position bristles with possibilities for friction, and is evidently highly unsatisfactory. It is clear, in our opinion, that if more development work is done than can be undertaken by the normal laboratory staff, in the normal time at its disposal and with the present equipment of the laboratory, some definite arrangement should be made in advance, and before any work is started. The arrangement should be (a) to do the work for a fee, the results to be the exclusive property of the client; or (b) if the work is done without a fee and the experiments are successful, that the first and succeeding orders should be placed with the firm undertaking the development work, and at prices calculated on a basis also agreed in advance.

Those who desire development work of this character to be undertaken for them should make careful inquiries before coming to definite arrangements. All constructional firms are not equally well equipped for development work. Those who supply steel, earthenware or other materials should only be asked to advise in matters that concern the use of their materials, otherwise the costs may be out of all proportion to the work done. Probably firms that supply complete plant units will generally be the best equipped to undertake experimental work, but this may not be so when only one or two unit processes are employed. There is always the possibility that a constructional or manufacturing firm may be in a position to develop the process in other directions and may act as development engineers, makers and salesmen. If this is desired it should also be taken into account in the initial stages. These are but a few of the considerations that arise, but perhaps enough has been said to indicate the complexity of the subject and the general principles involved.

Notes and Comments

Carbide Industry Inquiry

SIR ALEXANDER GIBB, in his recent address to the Chemical Engineering Group, cited the problem of establishing a calcium carbide industry in the United Kingdom as an outstanding instance of the need for close collaboration between the Government and the chemical engineer. When the Caledonian Power Bill was rejected in the House of Commons the Government apparently found it quite impossible to reach any conclusions as to whether, in the first place, carbide should or should not be manufactured in this country; secondly, whether it could be so manufactured efficiently and economically; and thirdly, whether the Highlands or South Wales, Lanarkshire or Durham, was the proper location. Obviously it is primarily a chemical engineering problem, but there was, at the time of the debate, no chemical engineer available to provide the information and knowledge on which a clear lead could be given or action taken. A committee of inquiry has since been appointed, and it is satisfactory to note that Sir Gilbert Morgan, director of the Chemical Research Laboratory at Teddington, has been selected as technical assessor. But so far as can be seen no chemical engineer has been included in the membership of the committee. The Government is not altogether to be blamed for the omission. The chemical engineering profession has not yet shown itself to be sufficiently interested in the broader questions of industrial planning to become regarded as an indispensable factor in such deliberations. The whole of Sir Alexander Gibbs' discourse was directed to the necessity for developing that wider influence which, once established, will ensure for chemical engineering that position which seems marked out for it.

Chemicals in the Overseas Empire

WE have lately had occasion to seek information about the chemical industry in the British Empire and have been surprised to find an almost entire absence of data except in the case of the larger dominions. The industry in Canada is well organised and capable of supplying all the information required at short notice. In India an enterprising industrial research bureau has just issued a bulletin which enables the rest of the Empire to appreciate the growth and development of the industry in that country. With regard to Australia and South Africa—as well as Canada—the operations of Imperial Chemical Industries, Ltd., and its subsidiaries may be taken to represent the bulk of the chemical industries. Turning to other parts of the Empire, however, we find the respective trade inquiry offices in London of little assistance, probably through no fault of their own, but because the chemical manufacturers and users in their laboratories have not availed themselves of the facilities for making their activities known beyond their own boundaries. "We know of no chemical works of any size in Jamaica"; "there are no chemical factories in Cyprus"; "there is no chemical industry in Southern Rhodesia"; "there is no chemical industry in Ceylon"; "apart from the processing of sulphide pulp and milling of zinc and lead concentrates, the chemical industry in Newfoundland is only carried out on very small lines." These are typical extracts from replies

to our inquiries, and they suggest either that there are opportunities for establishing new industries in those countries or that there is a considerable field for expansion of imperial exports, for there is no community that can flourish without chemical products. We are all Empire-minded at present with so many overseas visitors in London for the Coronation, and it seems to us that the time is opportune for British chemical manufacturers to take stock of the position and see whether they can create and supply new markets in the less enterprising corners of the Empire.

Dependence on Imported Oil

NO one knows the extent to which the oil from coal industry will eventually meet the demand for fuel oils, but it would be fantastic to suggest to-day that we are yet anywhere within reach of the time when we shall become independent of imported oil. The low temperature carbonisation process—primarily designed to produce solid smokeless fuel—is yielding increasing quantities of oil but is, at best, contributing but a small fraction to the national demand. The hydrogenation plant at Billingham has not shown results which would justify its description as a good commercial proposition—although it is developing a new field of chemical industry from which ancillary benefits of considerable value are being derived. Professor A. W. Nash told the Royal Society of Arts last week that hydrogenation plants capable of producing our entire peace-time oil requirements would cost probably £140,000,000, with a loss to the tax revenue of some £45,000,000 per annum. It is clear, therefore, that we must continue to import the bulk of our requirements which, as Professor Nash pointed out, do not encroach on the coal markets of this country as much as is popularly imagined, in that many of the industries that have been stimulated by the extended use of oil have at the same time called for more coal.

The National Defence Contribution

THE Federation of British Industries has submitted to the Chancellor of the Exchequer a statement of the general objections which, by a consensus of opinion, industry holds to the new National Defence Contribution. It is contended that the methods of assessing the tax are unduly complex, will create the greatest uncertainty as to a taxpayer's liability, will lead to serious disputes between the Inland Revenue Department and the taxpayer, will lay heavy costs on both taxpayer and Inland Revenue Department in collection, and will prove inequitable as between taxpayer and taxpayer, especially penalising the trades that have suffered most from the depression and new and progressive businesses. While acknowledging the relaxations outlined by the Chancellor in regard to the standard period and the capital standard, industry sees the greatest possible difficulty in the task of valuing capital. To render the contribution simpler to estimate and fairer to different classes of taxpayer, the Chancellor has been asked to substitute a temporary tax based in some way upon the assessments of profits for the purposes of Schedule D, with exemption for the small taxpayer and differential treatment for export trade to compensate for its greater risks.

International Association for Testing Materials

Two Hundred Papers Presented at Congress in London

THE International Association for Testing Materials held a congress in London on April 19-24, when over two hundred papers were presented.

The papers were divided into four main groups covering metals, inorganic materials, organic materials, and subjects of general importance. The metals group, under the presidency of Professor C. Benedicks (Sweden) covered such subjects as the behaviour of metals from a mechanical and chemical aspect as regards temperature, the progress of metallography, light metals and other alloys, and wear and machinability. Dr. F. F. Lucas (United States) dealt with general progress in the microscopic examination of metals, Dr. J. H. Gough, F.R.S. (Great Britain) devoted his contribution to characteristics of the deformation and fracture of metals as revealed by X-rays, and Professor G. I. Finch (Great Britain) contributed a paper on the study of metal films and surfaces by electron diffraction. The solidification of ingots was the subject of a paper presented by Dr. C. H. Desch, F.R.S. (Great Britain).

Papers dealing with inorganic materials, with Professor E. Suenson (Denmark) as president of the group, covered such subjects as concrete, the erosion and corrosion of natural and artificial stone, and ceramic materials. The organic materials group, presided over by Dr.-Ing. R. Barta (Czechoslovakia) included papers upon textiles, wood cellulose, timber preservation, the ageing of organic materials, colours and

varnishes. Dr. H. Phillips (Great Britain) contributed a paper on chemical tests for textiles, and Mr. W. D. Appel (United States) provided a paper on methods for testing the colour-fastness of dyed textiles. Two contributions from Mr. D. Johanason (Sweden) dealt with testing methods for determining the degree of cooking and strength of unbleached chemical pulp. Dr. L. A. Jordon (Great Britain) was the author of a paper on the physical attributes of paint and varnish films: Dr. G. Barr (Great Britain) considered the oxidation of mineral oils.

Subjects of general importance grouped together under the presidency of Professor H. Rabozée (Belgium) were concerned with the relationship between the results of laboratory tests and behaviour in use and service, the bearing of recent advances in physics and chemistry on the knowledge of materials, and the properties of materials for thermal and acoustic insulation of buildings.

Three papers of particular interest to readers of THE CHEMICAL AGE are reprinted in full below.

During the Congress a soiree was held at Burlington House by invitation of the President and Council of the Royal Society when the guests were received by Sir William Bragg as president of the Congress. Concurrently with the Congress an exhibition of testing plant and appliances was also held at the Institution of Civil Engineers, and visits were arranged to a number of works and laboratories.

Chemical Tests for Textiles

By D. H. PHILLIPS. Wool Industries Research Association, Headingley, Leeds

THE period since 1931 has been noteworthy for the increased application of X-rays to elucidate the structure of textile fibres: the sub-microscopic crystalline aggregates formed by the fibre molecules are long and thin, and lie with their long axes either parallel to the fibre axis (ramie, silk, animal hairs) or arranged spirally round the axis (cotton). The physical properties of wool and hair are linked with the folded condition of the normal fibre (α -keratin); the stretched fibre (β -keratin) gives the same X-ray photograph as silk fibroin.¹ The thin submicroscopic aggregates of cellulose are straight chains of glucopyranose units with a molecular weight of from 20,000 to 40,000.² The evidence³ suggests that the individual molecules in wool consist of long peptide chains, bridged across by disulphide links of cystine and by salt linkages formed between glutamic or aspartic acid and arginine, lysine or histidine.

The alteration and degradation of the disulphide grouping of cystine plays an important part in industrial processing and fibre damage.⁴⁻⁶ The sulphur content of unprocessed wool is, however, variable⁷ and besides that due to cystine includes methionine sulphur.⁸ Methods of testing the homogeneity of yarns have been examined⁹ and methods of quantitative analysis surveyed.¹⁰ Differential stains for sericin and fibroin have been discovered,¹¹ and it has been found that a solution of calcium thiocyanate will remove viscose rayon quantitatively from cotton.¹² Mixture of cotton and viscose rayon can also be analysed by alligation methods that take advantage of the difference in fluidity in cuprammonium or in differences in copper numbers after oxidation with sodium hypobromite.¹³ The method of measuring the fluidity of solutions of cellulose products in cuprammonium hydroxide, as standardised by the British Cotton Industries Research Association, has been given wide recognition in many countries. Full details have been published.¹⁴

Electrical methods for determining moisture in wool and cotton in bulk¹⁵ or in fabric form¹⁷ have received attention,

the inter-relations between humidity, mineral constituents and resistance having been placed on record.¹⁸ Methods have been described for measuring the absorbency of surgical cotton wool¹⁹ and of linen fabrics.²⁰ The absorbency of animal fibres is strongly influenced by the pH values of solutions with which they are brought into contact as is shown by investigations with wool,²¹ silk,²² silk gut²³ and horsehair.²⁴

Methods for the determination of small amounts of acids, alkalis and salts in textiles generally have been discussed²⁵; it has been suggested that the terephthalic acid and triethanolamine methods for the determination of sulphuric acid in wool should be replaced by one using pyridine,²⁶ and also that the wool should be steam-distilled in presence of sodium acetate.²⁷

Among accessory materials, tests for carding and spinning oils for wool have been re-examined, including the Mackey cloth-oil tester²⁸ and the fadeometer²⁹ for the oxidisability of oils. Methods have been described for the determination of starch,³⁰ zinc and magnesium,³¹ and total size³² in sized cotton goods, and of the acetyl content of cellulose acetate rayons by hydrolysis with 65 per cent. sulphuric acid and isolation in solvents of the acetic acid liberated.³³

The efficiency of wetting agents in general³⁴ and in various solvents³⁵ have been discussed, and the wetting powers and detergent actions of sulphated and sulphonated fatty alcohols compared.³⁶ The solubility,³⁷ testing³⁸ and selection³⁹ of dry-cleaning soaps have been studied, and the injurious imperitities in textile soaps⁴⁰ have been recorded.

Tests have been devised for the detection and identification of defects in fabrics caused during or after their manufacture by light and oxidation. A microscopical method to detect chemically tendered cotton⁴¹ and linen,⁴² and reagents for the detection of the oxidation of wet cotton during dyeing have been described.⁴³ The measurement of fluidity in cuprammonium has been used to assess tendering of vat dyed

cellulose fabrics,⁴⁴ linen fabrics,⁴⁵ and regenerated cellulose rayons,⁴⁶ and similar measurements in zinc chloride solution have been proposed to assess the tendering of silk.⁴⁷ The determination of the period of some defects in yarns has been shown to be connected with the appearance of defects in dyed, mercerised hose,⁴⁸ whilst defects arising during laundering can often be ascribed to undue stretching of the yarn during manufacture and the choice of an unsuitable structure for the fabric.⁴⁹

As the result of collaboration between the Society of Dyers and Colourists and the Wool Industries Research Association considerable progress has been made towards obtaining accepted standard methods for testing the fastness of dyed fabrics to light and to washing. Thus, fastness to light⁵⁰ is divided into eight grades, ranging from (1) very fugitive to (8) of highest fastness. Attempts are being made to correlate these new standards with those already proposed by other countries, but the work is still in the early stages. In addition to fastness to light, fastness to perspiration has been examined to obtain a standard test.⁵¹

Standards of fastness to light at present in use have been criticised and the necessity is stressed for stating the minimum percentage of the dye claimed as equal in fastness to the dyed standard pattern.⁵² Colour measurement is obviously of importance in these questions, and investigations have been made on the measurement of colour of dyed fabrics using the Ostwald colour system and the Guild trichromatic colorimeter.⁵³ Closely linked with the question of the fastness of dyed fabrics to perspiration is that of dermatitis due to dye-stuffs and other chemicals on fabrics. The various types of substances likely to cause dermatitis have been considered, tests elaborated for diamine and aminophenol intermediates,⁵⁴ and an extensive chemical examination has been made of the oxidation products of diamines.⁵⁵ It has been agreed that for suspected fabrics a "patch" test should be made on a sensitive person.

Metallic impurities in textiles often lead to defects and difficulties in manufacture. Spectroscopic analysis of the ash of vegetable and animal fibres has been advocated,⁵⁷ and microchemical methods have been elaborated for the determination of copper, iron and zinc in rayons.⁵⁸ Factors accelerating the growth of mildew in wool,⁵⁹ silk and cellulose acetate materials⁶⁰ have been elucidated.

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Testing the Colour Fastness of Dyed Textiles

By W. D. APPEL

DYED textiles are subject to the action of numerous agencies which may have a deleterious effect upon the colour. In the course of manufacture subsequent to dyeing, they may be scoured, fulled, carbonised, stoved, treated with acids, alkalis, or bleaching agents. In use, they may be exposed to light, weather, perspiration, water, sea water, rubbing, washing, dry-cleaning, hot-pressing. The stability of the colour when the textile is exposed to one of these agencies is

generally referred to as its fastness to that agency. Colour fastness does not depend only upon the kind of dye used. It depends upon the amount of dye, the kind of fibre to which the dye is applied, the method of application, the presence or absence of very small amounts of extraneous substances, and other conditions which are hard to control. Consequently, to establish the fastness characteristics of a dyed textile, a sample must be subjected to practical trials or

laboratory tests. Standard methods of testing fastness were provided in Germany in 1914 and have been amplified and revised in the light of the knowledge and experience gained since then.¹ In England, standard methods have been provided for fastness to light, washing, and perspiration after a series of very thorough studies of the problems involved.² In the United States standard methods have been developed for the more important kinds of fastness based upon independent studies.³

The fastness tests developed in the three countries are similar in principle in that series of standard dyeings of different degrees of fastness are provided, or presumably will be provided, for each test. The standards obtained from the central source of supply and the samples to be tested are subjected to a prescribed treatment. The effect upon the colour of each sample is then compared visually with the effect upon that of the standards. The sample is said to have the degree of fastness represented by the highest standard in the series which is found to be no faster than the sample.

This general procedure has a number of advantages. First, the testing equipment and treatments do not have to be accurately duplicated, for if the treatment is a little more severe one time than another both sample and standard will be affected alike. Second, the testing laboratory does not have the problem of reproducing the standards. This is done by the organisation which originally established them and is therefore best fitted to reproduce them when the supply is exhausted. Third, the problem of judging the effect of the treatments is greatly simplified. The tester does not have to rate the fading as slight, moderate, considerable, etc. He is concerned only with the question whether the change in colour of the sample is greater, equal to, or less than that of the standard. There is usually little difficulty in answering this question, regardless of the colours of sample and standard. Although much work has been done on the evaluation of fading by instrumental measurement of the colour change, an adequate method which is sufficiently simple, rapid, and inexpensive for general use is not available.

Glass-enclosed carbon-arc lamps are considered to be the most satisfactory for accelerated tests for fastness to light. Provision is made for avoiding excessive heating and for

humidifying the air about the samples during exposure in the Fade-Ometer used in the United States, the Fugitometer¹ and C.P.A. fading apparatus² developed by the Wool Industries Research Association and the Calico Printers' Association respectively and recommended by the British Committee. An exposure of one hour in the Fade-Ometer is equivalent to about 1.3 hr. of summer sunlight. Attempts to accelerate tests for fastness to light by increasing the intensity of the radiation much beyond that of direct sunlight have not been successful because the results do not duplicate those obtained on exposure to sunlight. Formerly, tests for fastness to washing were made by simply immersing the material in the test solution in a beaker, but devices for providing reproducible mechanical action are now available. The Launder-Ometer³ has one-pint glass jars mounted on a shaft. Rubber or metal balls placed in the jars with the samples to be tested and test solution provide the mechanical action when the shaft is rotated. A similar device is recommended by the British Committee.

Elaborate methods for testing fastness to perspiration have been developed by the British and American Committees, the first on the basis of a thorough study of the composition and reactions of human perspiration. No dyed standards are provided for these tests, though they are provided in the simpler tests of the German Committee for fastness to perspiration.

Intercomparisons of the three sets of standards for fastness to light of dyed textiles are being made in all three countries, and the hope has been expressed in all three that a single set of standards can be agreed upon. There appears to be no concerted effort at this time to arrive at international standards for fastness to other agencies.

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Properties and Stability of Metals at High Temperatures

By C. H. M. JENKINS, D.Sc., A.R.S.M., Metallurgy Department, National Physical Laboratory

METALS are primarily used to withstand stress and resist deformation, a condition which is as important at high temperatures as at atmospheric temperature. A rise in temperature, however, brings about increased mobility of the atoms, which affects the properties of the material as disclosed by tests and increases the surface activity towards surrounding media. This fundamental property forms the basis of the change in behaviour on increase of temperature. High temperature¹ is merely a relative term, for it is considered that "soft" metals are, at atmospheric temperature, somewhat similar to metals like iron, copper and aluminium at high temperatures.

An increase of internal mobility facilitates both softening and recrystallisation, whereas a decrease tends to produce, on deformation, a more marked occurrence of slip and work-hardening in the neighbourhood of the slip planes. Flow occurs in metallic aggregates in three ways which are not necessarily independent, namely:—by slip within the crystals, by grain boundary movement and by continuous recrystallisation under stress. Slipping is accompanied by local distortion around the slip planes. The influence of previous conditions is thus more likely to be apparent at low than at high temperatures, but experiments show that the initial preparation of the material by casting, rolling, forging, etc., sets up preferential orientation which is disclosed in the material even though the recrystallisation temperature of the material is

exceeded. The recrystallisation temperature is not a definite property of the material, but depends on the degree of deformation and the duration of exposure to heat. Various workers differ, in their interpretation of the experimental data, as to what constitutes the generation of new grain.

A small degree of distortion leads to a re-orientation without the formation of new grains,² as the formation of new grains under deformation at high temperatures appears to depend on a critical rate of distortion being exceeded. If, however, considerable deformation is applied, the final result is recrystallisation of the material. Recrystallisation and the formation of new grains appears to prevent the formation of intercrystalline cracks and favours the production of a trans-crystalline rupture.

The complexity of these changes is illustrated by normalised mild steel at high temperatures.³ Mild steel does not exhibit progressive weakening as the temperature is raised. At about 250° C. a maximum value in the tensile strength is found. This maximum is produced by the increased work-hardening of the material as, if the intrinsic hardness of the material is studied and the hardness determined by equating the degree of deformation to zero, it will be found that the material does not possess increased hardness at temperatures above air temperature. Below 400° C. considerable distortion of the crystal grains occurs, but above 450° C. recrystallisation of the crystal grains and spheroidisa-

tion of the carbide commences, but the latter is not well marked until 600° C. is reached. Deformation accelerates this spheroidising action. The ultimate structure of the material consists of ferrite and globular cementite and the material appears weakest in this spheroidised condition. This ultimate condition can also be attained by quenching mild steel from above the critical range; the resulting martensitic structure possesses a markedly different distribution of the carbide in the ferrite as compared with normalised mild steel. Prolonged annealing below the critical point will finally bring the carbide into the form of discrete particles.

The influence of chemical composition and the mode of manufacture of mild steels has been in part investigated,⁴ and evidence has been obtained that the ingot conditions are traceable in the final rolled product. Materials may be considerably strengthened by additions of other elements such as chromium and molybdenum, but some of these harder materials possess less ductility and are more prone to intercrystalline cracking in high-temperature service. The effect of age-hardening on the creep resistance of the material has not yet been determined, but from preliminary tests it appears that the relationship will have an important bearing on the suitability of this material to service under creep conditions.

An increase in internal mobility of the atoms is closely related to the surface attack of metals by the surrounding oxygen-bearing media (air, steam, carbon dioxide, etc.). After saturation of the initial layers with oxygen, the common metals form separate oxide phases on the surface. Corrosion, either in the form of scaling or the penetration of oxygen, and secondary effects such as decarbonisation are highly destructive actions but occasionally, as with certain chromium alloys, the metal is protected by the formation of relatively impermeable adherent scale. This fact is of considerable importance for high-temperature service, particularly in view of the large increase in volume of the oxide formed from the metal.

The "Review of Oxidation and Scaling of Heated Solid Metals"⁵ forms a comprehensive account of the theoretical aspects of oxidation, the constitution and the formation of scale on alloys and its quantitative estimation. The influence of other gases than air has been studied, and some of the practical aspects of scaling and oxidation have also been considered. Apart from the waste caused by oxidation in the manufacturing industries, oxidation at high temperatures in some cases may be a greater factor in the reduction of the service life than the degree of deformation from creep. An important factor in the rate of oxidation of iron and steel may be the acceleration of the rate of oxygen attack on exceeding the change in the constitution of iron oxide at 575° C.

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Conservation of Food

Some Special Problems

WHILE the term "conservation of food" may be applied to many aspects of the production and handling of foods, Mr. T. Macara, F.I.C., of the British Association of Research for the Cocoa, Chocolate, Sugar Confectionery and Jam Trades, confined himself in his recent lecture to the Royal Institution on "Science and the Conservation of Food," to problems connected with some common type of manufactured food. He used these to illustrate a number of the scientific principles

underlying the preparation of foods in such a manner that they will keep in a sound and saleable condition, without the use of preservatives. Before dealing with the selected problems, however, he first enumerated the various agencies, biological, physical and chemical which render food unfit for consumption or else merely unsaleable without being deleterious to health.

The first problems discussed were mould growth and fermentation, crystallisation, and absence of jelly property in jam. As regards mould growth and fermentation, he put forward the theory that their prevention depends on the production of a jam having a higher osmotic pressure than that of mould spores or yeast cells, and he showed how this result could be achieved. Crystallisation of sugars, or "graining," was explained during a brief account of the chemistry of the subject in which it was showed how the manufacturer is able to overcome these defects. The jelly property of jams is due to the fruit pectin, and it was shown how the jellifying property of this pectin may be lost or destroyed through lack of knowledge of its properties.

Mr. Macara also discussed problems connected with the preservation of fruits, vegetables, and meat products. He pointed out that the British Food Manufacturers' Research Association had found certain bacteria whose spores showed an extraordinary high resistance to heat. Boiling for 8 hours or heating to 230° F. for an hour failed to destroy them. These periods of time applied to small quantities of materials; when larger quantities had to be sterilised it was necessary to know the rate at which heat penetrated the product. The method of determining this was illustrated and explained. Some illustrations were given at the time necessary for the centre of certain commercial products to reach the desired temperature. The question of food storage in cans was shown to be one surrounded with difficulties, owing to the difficulty of obtaining cans free from defects in the coating of tin. It was stated that a number of cases had been met with where the cans became perforated after 3 or 4 months' storage.

Society of Public Analysts

Election of New Members

AN ordinary meeting of the Society of Public Analysts was held at the Chemical Society's Rooms, Burlington House, on May 5, the president, Dr. G. Roche Lynch, in the chair.

Certificates were read in favour of John S. Dunn, B.Sc., A.I.C., and Ernest Turner, B.Sc., F.I.C. The following were elected members of the Society:—Robert A. Bottomley, B.Sc., A.A.C.I., Paul Haas, D.Sc., Ph.D., David A. Lambie, B.Sc., A.I.C., Harry M. Rainey, and George R. Howat, B.Sc., Ph.D.

The determination of bismuth as phosphate was the subject of a paper by Dr. W. R. Schoeller, F.I.C., and Mr. D. A. Lambie, B.Sc., A.I.C. Bismuth phosphate precipitated from solutions containing sulphate is liable to be contaminated with sulphate, which loses sulphur trioxide on ignition. A modified phosphate method for the assay of high-grade bismuth ores was described, in which the interference of sulphate is overcome by an intervening precipitation with sodium carbonate. The advantages of the phosphate method over the gravimetric determination as bismuth oxide are discussed.

Various forms of apparatus suitable for the easy distillation of small quantities of concentrated nitric, sulphuric or hydrochloric acid were described by Dr. H. I. Coombs, who pointed out that acids free from metallic impurities can readily be obtained in this way.

A new apparatus for the more rapid and economical determination of the freezing-point of milk was described by Mr. P. L. Temple. The essential principle of the apparatus is that the measurement takes place in a bath of calcium chloride solution freezing at -2.3° C. This temperature is continuously maintained by circulated brine thermostatically controlled at -5° C. The results obtained agree closely with those given by the Hortvet apparatus, and many of the drawbacks of the latter are eliminated.

Colloidal Properties of Hydrous Alumina*

By THURSTON ERIC LARSON

THIS investigation concerns itself with the possibility of obtaining very low residual hardness in water softening by the lime soda process, and with the chemistry of hydrous alumina with relation to water treatment. The increased usage of improved water has already increased the demand for efficient treatment. Aluminium compounds have long been in use as aids for coagulation and softening. More recently sodium aluminate has been used with success varying with the conditions under which it has been used. Through failure to apply known facts and lack of data, the mechanism of coagulation using aluminium salts and the limits of the results possible have not been determined.

Solubility of Calcium

Using activity coefficients derived from ionic strength of solutions containing non-incrusting salts to give $\mu_{\frac{1}{2}} = .026$ to $\mu_{\frac{1}{2}} = .105$, the solubility of calcium as CaCO_3 , $\text{Ca}(\text{HCO}_3)_2$ and $\text{Ca}(\text{OH})_2$ (calculated as CaCO_3), is found from activity product of Johnstone¹ to be from 13.5 p.p.m. to 18.0 p.p.m., and that of magnesium hydroxide (calc. as CaCO_3) from the activity product of Kline² is found to be from 11.1 p.p.m. to 14.0 p.p.m. However, the magnesium hydroxide in solution tends to reduce the solubility of calcium as hydroxide and bicarbonate by reversing the hydrolysis.



This reduces the calcium solubility (calc. as CaCO_3) to 10.0 p.p.m. to 19.6 p.p.m. The minimum residual hardness of water treated with equivalents of lime and soda ash should therefore be from 20.0 p.p.m. to 27.6 p.p.m. (calc. as CaCO_3) depending on the ionic strength of the solution.

Further reduction in residual hardness may be had by increasing the hydroxyl ion concentration, by addition of equivalents of lime and soda ash, sodium aluminate or some other reagent which will give alkali hydroxide. In this manner magnesium solubility, will be reduced to be in proportion to the inverse square of the residual hydroxyl ion concentration, and the calcium solubility will be reduced by the mechanism cited above.

For a water of low non-incrusting mineral content of (55 p.p.m. NaSO_4) $\mu_{\frac{1}{2}} = .04$ after softening, and treatment with theoretical equivalents of lime and soda ash should give a residual hardness of 21.4 p.p.m. (as CaCO_3). If $\frac{1}{2}$ gr./gal. sodium aluminate were added this value should be reduced to 17.7 p.p.m. and $\frac{1}{2}$ gr./gal. sodium aluminate should bring this value to 13.9 p.p.m. The values of low residual hardness (10.3 to 20.4 p.p.m.) reported in the literature³ were in each case obtained with the aid of excess hydroxyl ion or heat or both. Increase in temperature of course increases the rate of reaction, and decreases the solubility of the incrusting salts.

Enhancing Coagulation

Softening in practice seldom gives residual hardness values as low as those calculated without the use of chemicals that enhance coagulation. It is seen that the use of a compound such as sodium aluminate should enhance coagulation by forming the insoluble hydrous alumina floc, and decrease residual hardness by producing additional hydroxyl ions on hydrolysis.

Cataphoresis experiments were made to determine the isoelectric point of aluminium hydroxide. The apparatus was of the ultramicroscope type using a cell devised by Mattson⁴ and applying corrections for endosmotic flow and optical⁵ errors due to the difference of index of refraction of the glass and liquid. pH determinations were made with the glass electrode. It was found that aluminum chloride with sodium hydroxide hydrolysed to give positively charged particles when the

initial pH was above 8.2 and negatively charged particles when the initial pH was below 8.2. This checked the work of Mattson⁶. Prolonged stirring or ageing increased or decreased the pH approaching the isoelectric value when the initial pH was respectively not too far below or above the isoelectric value. Aluminium sulphate gave similar results except that the isoelectric point broadened into a zone extending down to a pH of 7.5. This also checked the data of Mattson⁶, and it is seen from that data of Miller⁷ that the formation of basic aluminum sulphates takes place varying in composition with the amount of sulphate concentration and the pH or hydroxyl ion concentration. Each of these highly insoluble basic aluminum sulphates should have its own particular isoelectric point thereby accounting for the zone of isoelectric which is found when sulphate is present.

Effect of Ageing

It should be noted that the charged colloidal particles are found after initial hydrolysis and that adsorbing and coagulating effects of charged colloids have their effect at this time. Ageing inhibits these highly potent properties of colloidal hydrous alumina and this fact should be considered in problems involving its use, colour and turbidity removal in coagulation, and colloid removal in softening being only some of the uses to which this may be applied. Magnesium hydroxide floc was found to be of positive charge and calcium carbonate was found to be of negative charge in all cases observed.

Attempts were made to form an insoluble magnesium aluminate in the presence of hydroxyl ion. Varying amounts of sodium aluminate were added to magnesium chloride with stirring. The analyses⁸ for aluminium and magnesium showed that the magnesium precipitated as a function of the hydroxyl ion concentration and that aluminium precipitation was enhanced considerably by presence of carbonate or bicarbonate from CO_2 absorption. The conclusions of Heyrovski⁹ on the solubility of magnesium aluminate are shown to be without complete evidence. It can be pointed out that the formation of a highly insoluble magnesium aluminate does not explain the low magnesium hardness often found when sodium aluminate is used, because the aluminate concentration is so low that even if it did form, the excess magnesium would necessarily have to follow the solubility or "activity" product equation for magnesium hydroxide. The effect would be to remove aluminate rather than to increase magnesium removal.

Tests on Two Types of Water

Series of tests were made on two types of water; University of Illinois water, a carbonate water (bicarbonate equivalents greater than the sum of magnesium and calcium equivalents); and the same water treated with sulphuric acid to give a non-carbonate water (no sodium bicarbonate present). All samples were aerated thoroughly to remove CO_2 before softening. These waters were softened using varying amounts of lime and soda ash, or lime alone, above and below the theoretical softening requirements. The results agreed approximately with the theoretical discussion above on hydroxyl concentrations, although the minimum hardness values predicted were never reached. When sodium aluminate was also added the residual hardness was always lower, and more often than not it was lower than could be accounted for by calculation involving excess hydroxyl ion. It was noted that magnesium hydroxide precipitation took place before calcium carbonate precipitation. Softening carbonate waters was similar to treatment of non-carbonate water with excess soda ash.

Since practically all natural and ground waters have some soluble silica and since various investigators^{10, 11} have found that there is some relation between soluble silica and magnesium and aluminate, synthetic waters were composed simi-

*Abstract of Thesis submitted for the degree of Doctor of Philosophy in Chemistry, University of Illinois, 1937.

lar to University of Illinois water with controlled amounts of soluble silica. Softening tests were made on these waters, with and without sodium aluminate and with and without control of the residual hydroxyl and carbonate concentrations. The results show, as has more recently been shown by Baylis¹², that silica in some form has some effect on coagulation whether aluminate is added or not. Either no silica or large amounts present gave colloidal solutions with no aluminate. When the hydroxyl and carbonate concentrations were controlled, the residual hardness was but slightly improved by the presence of increasing amounts of silica or aluminate as long as a good flocculant precipitate was formed. The silicate as aluminate probably acts as a catalyst speeding up equilibrium, and as coagulating agent in the same manner that negatively charged colloidal alumina or aluminosilicate acts to neutralise positively charged $Mg(OH)_2$.

Some of the possible limits of softening by treatment with lime and soda ash with or without sodium aluminate were calculated for solutions of varying ionic strengths. The isoelectric point of aluminium hydroxide has been found to be at a pH of 8.2 when only monovalent ions were present, confirming the work of Mattson⁵. This isoelectric broadened to a zone when aluminum sulphate was used. It was found that coagulation took place as the pH approached the isoelectric point on ageing of the solution or prolonged stirring of the solution, and that the isoelectric pH changed with the type of foreign ions present.

Hydroxyl ion was found to be more effective in precipitation of magnesium than aluminate ion. The residual aluminate is lower when carbonate concentration is increased. Softening carbonate and noncarbonate waters with and without sodium aluminate agreed approximately with theoretical calculations, but quantitative results were not expected since equilibrium was never reached in any of the tests. The presence of silicate or aluminate was shown to be no more efficient excepting that a better floc was formed resulting in removal of colloidal particles. No silica or high silica produced turbid solution when softened. Aluminate had little effect if no silicate was present, but greatly enhanced coagulation if high silica concentration was present.

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Institute of Chemistry

April Examination Results

THE Institute of Chemistry has issued its pass list in connection with the April examinations as follows:—

Examination in General Chemistry for the Associateship: S. Ackroyd, B.Sc. (Lond.), Municipal Technical College, Halifax; D. F. Barratt, City Technical College, Liverpool; G. Beeston, City Technical College, Liverpool; J. Birch-enough, A.M.C.T., College of Technology, Manchester; A. Brear, B.Sc. (Lond.), Municipal Technical College, Halifax; H. R. Broomhall, B.Sc. (Bris.), University, Bristol; G. Browne, B.Sc. (Lond.), Polytechnic, Regent Street, and Sir John Cass Technical Institute, London; J. F. Byrne, Technical College, Cardiff; A. Cambitzi, University College, London; H. G. Cooper, A.M.C.T., College of Technology, Manchester; C. Dagnall, A.M.C.T., College of Technology, Manchester; W. T. Dean, B.Sc. (Manc.), University, Manchester; R. Dungey, King's College, and Northern Polytechnic, London, and Harris Institute, Preston; D. I. Duveen, University, Oxford, and Battersea Polytechnic, London; J. A. Ealey, West Ham Municipal College, London; R. L. Ford, City Technical College, Liverpool; D. H. Geard, B.Sc. (Lond.), Central Technical College, Birmingham, and Chelsea Polytechnic, London; C. C. Gough, City Technical College, Liverpool; J. Gourlay, Royal Technical College, Glasgow; D. Haigh, A.M.C.T., College of Technology, Manchester; C. E. Hall, City Technical College, Liverpool; G. E. Harrison, College of Technology, Leeds; W. Hartley, Municipal Technical College, Hull; J. F. Hearne, Central Technical College, Birmingham; C. G. Holt, B.Sc. (Lond.), Battersea Polytechnic, London; J. Ireland, City Technical College, Liverpool; D. L. C. Jackson, Central Technical College, Birmingham; W. R. Jones, Royal Technical College, Salford; G. Lawson, Ph.C., Royal Technical College, Glasgow; J. W. Lowry, B.Sc. (Lond.), Chelsea Polytechnic, and West Ham Municipal College, London; F. A. Lyne, B.Sc. (Lond.), University College, London; C. D. B. Moon, Birkbeck College, London; J. W. Oswald, Regent Street Polytechnic, London; J. M. Phillipson, Regent Street Polytechnic, London; R. D. Ray, B.A. (Cantab.), University, Cambridge, and Chelsea Polytechnic, London; J. G. Reynolds,

City Technical College, Liverpool; F. C. Saville, Sir John Cass Technical Institute, London; G. E. H. Skrimshire, Regent Street Polytechnic, London; N. W. Sqaunce, B.Sc. (Lond.), Regent Street Polytechnic, London; A. E. Thorn-dyke, Regent Street Polytechnic, London; G. H. F. Walker, City Technical College, Liverpool; W. J. Weir, Technical College, Derby; Northern Polytechnic, London; Royal Technical College, Glasgow, and Technical College Paisley; J. S. West, B.Sc. (Lond.), Loughborough College, Leicester-shire; C. E. Winsor, Municipal Technical College, Black-burn; L. F. U. Wix, B.Sc. (Lond.), Technical College, Brighton, and University College, London.

Examinations for the Fellowship: In Branch A: Inorganic Chemistry, with special reference to Metallurgical Analysis, etc., H. Stant; in Branch C: Organic Chemistry, with special reference to Oils, Fats and Waxes, H. R. C. Pratt, B.Sc. (Lond.); in Branch E: The Chemistry, including Microscopy, of Food and Drugs, and of Water, T. E. Barnes, B.Sc. (Lond.); R. G. Harry, D. Miller, B.Sc. (Lond.); in Branch F: Agricultural Chemistry, L. T. Lowe, B.Sc. (Manc.); in Branch G: Industrial Chemistry, with special reference to Liquid Fuel, E. G. Hancock, M.A., B.Sc. (Oxon.), M.Sc. (Lond.); in the Chemical Technology of Textiles, with special reference to Artificial Silk, H. Sagar, A.M.C.T.; in General Analytical Chemistry, E. Q. Laws, B.Sc. (Lond.).

United States Pyrites Industry in 1936

REFLECTING increased activity in the chemical industries, domestic pyrites production established a new record high in 1936, according to the United States Bureau of Mines. Output rose to 547,236 long tons containing 39.6 per cent. sulphur compared with 514,192 tons containing 39.5 per cent. sulphur in 1935. Of the 1936 total 361,482 tons were consumed by the producing companies and 181,494 tons were sold compared with 348,891 tons and 163,911 tons in 1935. Twenty-one per cent. of the output was reported as lump and the remainder fines, the bulk of the latter being flotation concentrates.

Hydrogen Ion Concentration

Its Importance in Industry

DR. M. E. D. JARRETT, of The Walpamur Co., Ltd., gave a brief account of the practical determination of hydrogen ion concentrations in a paper before a recent meeting of the Manchester Section of the British Association of Chemists, at Accrington. He said that reference is usually made to the pH rather than to the hydrogen ion concentration except, perhaps, in the case of strongly acid solutions, since it is a more convenient and suitable means of expression. The pH is the negative logarithm to the base 10 of the hydrogen ion concentration. Thus pH 0.3 corresponds to strong acidity, pH 7.6 to neutrality at $18^{\circ}C$., being the pH of pure water at that temperature, pH 11.14 to strong alkalinity, and intermediate values to either mild acidity or alkalinity according as to whether they lie below or above pH 7.06 respectively.

Whatever may be the interpretation eventually placed on hydrogen electrode potentials the pH scale will remain a very convenient and useful one, forming an excellent means of correlating true acidity and alkalinity and of investigating reactions affected by, or associated with changes of, the hydrogen ion concentration. However, with strong electrolytes, the ion concentration idea is far from satisfactory, and although it may still form a working basis in many cases, especially in dilute solutions, it must eventually give way to ion activities. In that case the pH scale will be superseded by a paH scale, referring to hydrogen ion activities, differing slightly in magnitude.

Chief Methods of Determination

The chief methods of determining hydrogen ion concentrations can be classified as (a) potentiometric, which make use of certain electrodes the potentials of which are determined by the hydrogen ion concentrations of the solutions in contact with them, and (b) colorimetric, employing compounds giving coloured solutions of which the colour depends on the hydrogen ion concentration.

The most important electrodes used in the determination of hydrogen ion concentrations by the potentiometric method are the hydrogen, quinhydrone, oxygen, antimony, tungsten, and glass. A very large number of designs for the various electrodes have been described, each being especially suitable for a particular purpose. There are "immersion" electrodes for use in the laboratory or in the factory, usually of rather robust nature and designed so that they can be easily manipulated, and of the "flow" type, placed either directly in the main stream of liquid or in a very small stream tapped off the main one. These two types may be used in conjunction with automatic control and recording apparatus.

All other electrodes are standardised against the hydrogen electrode. The quinhydrone electrode is very popular, being simpler than the hydrogen type, more fool-proof, and having fairly general application below pH 8. The glass electrode deserves special mention on account of its unique nature and since it came into use only relatively recently.

Development of the Glass Electrode

The development of the glass electrode, resulting from the discovery of Haber and Klemensiewicz in 1909 that the potential between a glass surface and a solution in contact with it was determined by the pH of the latter, has led to what is, perhaps, the most remarkable and fruitful advance ever made in the determination of hydrogen ion concentrations. It can be used where all other electrodes fail. It functions quite satisfactorily in the presence of strong oxidising and reducing agents, all cations and anions and all types of precipitates, so that it is of almost universal application. However, it appears that it cannot be used in the presence of high concentrations of ethyl alcohol, acetic acid and gelatin.

The glass electrode requires calibration in order to convert

its potentials into pH values. Between a pH of 2 and 10.5 the potential is a rectilinear function of the pH , and although outside this range deviation from the rectilinear relationship occurs, the glass electrode may still be used after suitable calibration. In this electrode we have an almost foolproof, accurate hydrogen ion indicator of very wide applicability which must, before long, find general use in the control of industrial processes, replacing many of the less suitable electrodes now employed.

Colorimetric Methods

With regard to the use of colorimetric methods, everyone who has ever made use of these methods will be fully aware of the difficulties which are frequently involved, and of the limitations to which they are subject. In this connection, mention may be made of the difficulties met with in using coloured and turbid solutions, and the errors arising from the presence of salts, proteins, alcohols, etc., variations in temperature, the effect of the acidic or basic character of the indicators on the pH of unbuffered solutions (*i.e.* acid error) and the phenomenon known as dichromatism.

Neutralisation and acid base precipitation reactions are two types of reactions which are of fundamental importance in work concerning hydrogen ion concentrations. A very interesting practical application of the latter is met with in the proposal to make use of the different dissociation constants of the alkaloids in connection with their separation and purification, in so far that by treating a solution of their salts with an aliquot quantity of alkali, the salt of one, the weakest, may be decomposed while the salts of the other remain unaffected so that the former may be extracted with a suitable organic solvent. A case where the method would work excellently is the separation of the alkaloids obtained from the root of the golden seal plant, namely, hydrastine and berberine, which are precipitated at approximately pH 6.3 and 11.6 respectively.

The pH at which a base is precipitated from a solution of its salt depends primarily on its solubility product, and when the metal ion concentration does not vary to any great extent can be regarded as characteristic of the base.

Hydroxide Precipitation

The work of Britton and his collaborators shows that a pH value can be ascribed to each heavy metal base, at which it will be precipitated from dilute solutions (0.01-0.02N) of its salts with strong acids. Hence, to each metal base a characteristic "hydroxide precipitation pH " may be ascribed, *e.g.* Mg 10.4; Zn 7.1; Cu 5.5; Al 4.1; Th 3.5; Fe⁺⁺⁺ 2.7. Use may be made of the widely different pH values at which various metals are precipitated for their controlled separation. If the type of pH curve is considered which would be obtained on titrating a solution 0.02M with respect to H_2SO_4 , Fe₂(SO₄)₃, CuSO₄, MnSO₄, and MgSO₄ with 0.1N NaOH it will be seen that a definite inflection occurs on the completion of the precipitation of each cation, so that each precipitated metal may be filtered off in turn.

In order to control the separations, *i.e.*, the pH values set up, use may be made of buffer solutions or indicators, although where precipitation pH 's lie fairly closely together electrometric control must be used. An example of such controlled separations is:—The precipitation of the hydroxides of Fe⁺⁺⁺, Al, and Cr⁺⁺⁺, in the presence of Co⁺⁺, Ni, Mn⁺⁺, and Mg in analytical separations depends on a suitable buffering of the pH with ammonia and ammonium chloride. Numerous other analytical separations also depend on an automatic control of the pH .

The importance of the minimisation of the corrosion of iron and steel structures can hardly be overestimated. It has been

found that, in the absence of oxygen, the rate of corrosion of iron is almost a linear function of the hydrogen ion concentration up to pH 9.4 above which it usually ceases. Probably the efficiency of red lead in metal primers is associated with the high pH , it can set up when in contact with water, although, no doubt, its oxidising power is important.

The pH frequently has a considerable effect on the efficiency of preservatives, especially when these are the salts of weak acids and bases. Thus while the preservative action of sodium chloride and formaldehyde is generally not much affected by the pH , the action of sodium salicylate, sulphite, benzoate, etc., depends largely on the pH , making it appear as if the weak acids rather than their ions were the preservative agents. Thus sodium benzoate cannot be used in preserving non-acid fruits such as ripe olives and meat products. Generally bactericidal action is much more effective at pH values below 4.5, whether by steam or by chemicals.

In the case of toilet preparations and cosmetics, the pH value of the preparations or, in the case of a dry powder, the pH it develops in the presence of water, is of considerable importance, for solutions of pH value 10 and above frequently have an irritating action on the skin. Face powders normally contain a large percentage of zinc oleate. It has been proposed to use magnesium oleate in place of the zinc salt in order to lower the proportion of metal, which is regarded as very desirable.

The various processes for sewage disposal all benefit from hydrogen ion control and, in particular the automatic control of the milk of lime or acid addition. The pH of the liquor very largely determines the rate of microbial action, the disagreeable odours produced, and the characteristics of the sludge, including the ease with which it is filtered.

Although pH control in the textile industry is still in its

infancy it has proved to be of considerable importance. The animal fibres, wool and silk, being protein bodies and hence amphoteric in nature, are most markedly affected by the pH values at which they are kept during the various processes to which they are subjected. Vegetable fibres and artificial silks, showing no marked acidic or basic properties, are not so obviously affected by pH changes but, nevertheless, an effect is still observed. The degumming of silk requires a bath of pH 10.0-10.5, these alkalinities being the maximum to which the fibres may be safely subjected. pH control is also important in both alkaline and acid bleaching, in that it enables the best bleaching to be obtained with minimum effect on the fibre structure and at minimised rate of decomposition of the bleaching agent.

In addition to the industries mentioned pH control is of importance in others dealing with leather, electro-plating, baking, sugar manufacture, milk and milk products, paper making, brewing and pharmaceutical products. Mention may be made of the "liming process" for the removal of hair, etc., the reduction of the swelling caused by such treatment, the removal of undesirable proteins, the bringing of the pH of the leather to a suitable value for tanning, either vegetable or chrome, and also the tanning itself. In the various processes for the clarification of sugar juices, the careful control of the pH is essential for maximum efficiency and in order to avoid the inversion of the sucrose or the alkaline decomposition of the reducing sugars present.

In nickel plating the pH of the nickel sulphate bath must be kept within the limits 5.2-5.8 by the controlled addition of sulphuric acid or nickel carbonate. If the pH of the bath falls below 5.0 the current efficiency is lowered by the evolution of hydrogen, while if it rises above 6.0 the coating of nickel becomes poor and is liable to flake off.

The Heavy Chemical Industry of India A Bright Future Predicted

AN important review of the heavy chemical industry of India with the conclusion that the future before it is bright, is contained in a bulletin published by the Industrial Research Bureau of the Government of India. This review is the work of Mr. N. N. Sen, Superintendent of the Government Test House at Calcutta, who traces the growth and development of the heavy chemical industries of India.

The limiting factor in the production of sulphate of ammonia is the extent of the country's requirements of gas and metallurgical coke. It does not seem likely that the consumption of these products will increase markedly in the near future, but it is possible that all the ammonia at present released by the destructive distillation of coal in the country is not being recovered as sulphate. There is presumed therefore to be a possibility of obtaining a greater yield of this fertiliser from the present state of the coke and gas industries. When a genuine demand for fertilisers on an all-India scale is created, there can be little doubt that superphosphate will engage the attention of the Indian heavy chemical industries more than any other phosphatic fertilisers, old or new.

The cost of production of sulphuric acid holds one of the keys to the future of the heavy chemical industries in India. A flourishing superphosphate industry will so increase the scale of production of sulphuric acid that the general level of the cost of its manufacture will be considerably lowered. A low cost of sulphuric acid will enable a large number of other heavy chemicals to be produced more cheaply than has hitherto been the case. The question of utilising Indian rock phosphates will require to be investigated more thoroughly than has hitherto been the case, if the demand for superphosphate becomes sufficiently large. The scale of production of this fertiliser in European countries is so large and the cost of sulphuric acid in these countries is so low that Indian manu-

facturers will continue to be at a disadvantage if rock phosphate has to be imported from North Africa.

Discussing the suitability of different sources of production, the review says native sulphur deposits cannot be worked for the economic supply of sulphuric acid, while Indian deposits of pyrites are also not considered suitable. Enormous quantities of sulphur are obtainable from the Bawdwin mines in Burma if permitted by economic and transports considerations. Another source is gypsum, of which large deposits are available.

It seems highly desirable that the subject of utilising gypsum as a raw material for sulphuric acid should be closely investigated by Indian manufacturers. If it should appear possible to manufacture sulphuric acid economically from gypsum, this will not only be a safeguard against a possible collapse of the Indian chemical industries in times of war, but may actually lead to a cheaper production of sulphuric acid in the country. The most important factor affecting the development of the heavy chemical industries is the state of the other industries of the country. Considerable industrial development has already taken place in the country during the last 20 years, but a vast deal more is to follow.

There is no reason why, instead of being an importer of soaps, India cannot be an exporter, provided that the necessary quality can be attained by the majority of the manufacturers. The glass industry is another large user of heavy chemicals, particularly soda ash, and there is much room for the development of this industry in India. The leather industry consumes a variety of heavy chemicals, although the scale of consumption is comparatively low. Large quantities of untanned hides and skins are exported from this country, and if a substantial proportion of these is tanned before being exported, the Indian heavy chemical industries should benefit.

Recent Textile Processing Developments

By A. J. HALL, B.Sc., F.I.C., F.T.I.

THE weighting of viscose and acetate rayons continues to attract the inventive ingenuity of textile chemists for the simple reason that if a simple effective process could be devised it would be extremely valuable. Actually what is required is not so much a weighted or heavier rayon as a swollen rayon. If the individual fibres could be filled out with insoluble metallic compounds, or in fact any inert substance, then yarn made from these fibres would have more bulk and would "cover" more when woven or knitted into fabric. It is really this extra "cover" which is required of the weighted rayon so that the fabric will appear denser and more compact. So far, no entirely satisfactory weighting process has been devised for rayons, but there should be a good reward for the first successful one. Recently two new processes have been disclosed, and it remains to be seen how far these will be adopted on the large scale.

Weighting Processes

The first process (Brit. Pat. 442,585) has a special feature of interest in that such cheap and simple substances as glycerine, ethylene glycol, and other polyhydric alcohols which can easily be applied to the rayon and also penetrate it well are used. Such substances are water-soluble, but it is found that they can be fixed in the rayon by means of a synthetic resin of the urea-formaldehyde type. The weighting process consists of impregnating say a viscose rayon crêpe fabric with a liquor containing a half-condensation resin product, an acid catalyst (for example, lactic acid), and the weighting substance, followed by drying at a low temperature, and then heating at a high temperature for a short time (200° C. for 50 seconds) in order to complete the condensation and fully harden the resulting resin. It is claimed that the rayon can thus be weighted up to 30 per cent. and yet remain quite soft.

The second weighting process is especially suitable for acetate rayon; it utilises stannous chloride instead of the stannic chloride which has for many years been used for real silk. When the usual weighting process, consisting of treating the textile material with a solution of the tin salt followed by rinsing and fixing with disodium hydrogen phosphate, is used it is found that a considerable proportion of the insoluble tin phosphate is left adhering to the outside of each fibre instead of being permanently fixed within it. To avoid this defect the process is varied (Brit. Pat. 441,868) by padding the rayon with, say, a stannous chloride solution, then removing all excess of liquor by hydroextraction, followed by drying at 50° C. and then steaming in a closed chamber (ammonia gas is injected) at 100° C. for a few minutes. Under these conditions the tin hydroxide thus formed is fixed within the rayon fibres, this being due to the swelling of the fibres due to the steaming.

Absorption of Oxygen

Although cotton materials have excellent durability they rapidly lose strength and elasticity when subject to oxidation. It is therefore useful to have the research results of D. J. Salley ("Textile Research," 1937, 7, 133), who has recently investigated the absorption of oxygen by mercerised cotton when exposed to this gas at temperatures varying from—180° C. (the temperature of liquid air) to 110° C. A rapid Van der Waal's adsorption of the usual type was observed at the very low temperatures, but between 0° and 80° C. the cotton adsorbed oxygen at a slow rate. A distinct difference was noted above 80° C. for then the rate of adsorption increased sufficiently to indicate that oxidation of the cotton occurred. It is therefore to be inferred that at these higher temperatures mercerised cotton will lose strength by oxidation.

It is often assumed that the presence of iron in cotton can assist its oxidation, but Salley found this was not true within the conditions of his investigations. Salley's results can be

usefully compared with those previously obtained by Davidson ("J. Text. Inst.," 1934, 25, 95T). Quite a different type of oxidation of cellulose has been further investigated by Nabar, Scholefield, and Turner ("J. Soc. Dyers and Col.," 1937, 53, 5). For a long time it has been known that the presence of the leuco form of certain vat dyes in cotton or cellulose rayon can accelerate oxidation as induced by exposure to light or to an oxidising solution. An extraordinarily high rate of damage can thus be produced when cotton having within it a suitable vat dye (Cibanone Orange R) is immersed in a solution of sodium hypochlorite, this damage being easily measurable by means of the cuprammonium viscosity test.

Slow Oxidation

When cotton is subject to comparatively slow oxidation with hypochlorite solutions it has been found that the resultant changes in the cellulose as shown by its lowered viscosity in cuprammonium solution, its higher Copper Number, and its solubility in caustic soda, are very complex and bear no simple relation to the amount of oxygen consumed in the oxidation. It is now found that in the accelerated oxidation (that is, in the presence of a reduced vat dye) the oxidation process is more simple and the oxygen consumed bears a simple relationship to the changes of the above-mentioned properties. It thus appears that cellulose oxidation under accelerated conditions is a process which requires special study and that it is not to be confused in any way with the behaviour of cellulose when subjected under ordinary conditions to hypochlorite liquors such as are used in commercial bleaching of cotton and rayon.

For estimating the amount of free sulphuric acid in acid-treated wool a number of methods are available, including those using triethanolamine (Trotman and Gee, "J. Soc. Dyers and Col.," 1932, 48, 321), terephthalic acid (Hirst and King, "J. Soc. Dyers and Col.," 1926, 42, 171), and distillation with sodium acetate (Trotman and Gee, "J. Soc. Dyers and Col.," 1933, 49, 132). Recently these methods have been compared by A. Eavenson and J. W. Creely ("Amer. Dye-stuff Rep.," 25, 719) and it has been found that they are not so suitable for works control purposes as the method involving extraction of the wool with pyridine and direct titration with alkali as described by J. Barritt ("J. Text. Inst.," 1935, 26, 87T). Actually, however, Barritt's method has been improved upon and the following procedure is now recommended. 5 grams of the acid wool is placed in a 500 c.c. flask and 300 c.c. of nearly boiling 0.5 per cent. pyridine solution added. After shaking for 5 minutes 150 c.c. of the liquor is withdrawn and titrated with 0.051 N. caustic soda solution using phenolphthalein as indicator. Each c.c. of alkali used indicates an acidity of 0.1 per cent. If the pyridine solution is used at room temperature then the period of extraction must be increased to one hour.

Printing of Vat Dyes on Cotton

The printing of vat dyes on cotton is important since in these days there is an increased demand for colourings on textile materials which can be guaranteed as being fast to light and washing. In the printing process the vat dye is fixed by steaming the fabric under reducing conditions so that the dye becomes soluble and so penetrates the fibre substance. By having present on the cotton an oxidising agent it is obviously possible to prevent fixation of the vat dye, and this is the principle underlying reserve printing processes. Aromatic nitro compounds are oxidants and for this reason J. S. Turski and J. Checinski ("Textilberichte," 1937, 18, 87) have investigated the possibility of using dinitrobenzene and dinitronaphthalene as reserving agents in vat dye printing. Actually these two substances have been found quite satisfactory, but trinitrotoluene was unsatisfactory.

In the reserve printing methods described, the fabric is first printed with a highly dispersed suspension of the dinitro compound before application of the vat dye printing paste. This dispersion is effected with the dinitro compound in its molten condition (dinitrobenzene is better in so far as it has a lower melting point than dinitronaphthalene) and it is preferably thickened with gum arabic since this appears to favour clarity in the resulting reserve be it white or coloured.

Vat dyes are better fixed in printing processes so that the resulting coloured effects are faster and more vivid and in-

tense if there is present (Brit. Pat. 446,488) in the printing paste a small proportion of a betaine derivative. Among the betaines which have been found useful are ethyldimethylbetaine, tributylbetaine, and benzyldibutylbetaine. It may be remembered that pyridine derivatives of betaine have also been found advantageous. (Brit. Pat. 420,095) for this same purpose. In some instances it is better to apply the betaine to the fabric before application of the vat dye printing paste, but generally it is recommended to add the betaine compound to this paste.

Yeast Albumen from Spent Sulphite Liquors

Recent Investigations in Germany

GR EAT efforts are still being made in Germany to produce from internal resources as many as possible of the country's requirements and so become independent of imports. One particular investigation concerns methods whereby the albuminous constituents of cattle food can be obtained. One of the ways suggested is the production of yeast on a large scale by the fermentation of wood sugar obtained by the Bergius and Scholler-Tornesch processes of obtaining wood sugar by hydrolising waste wood, and at the 49th Conference of the Ver. Deutsche Chemiker held at Munich in July, 1936, Professor Dr. Hermann Fink and Dr. Richard Lechner were responsible for a paper reporting results in yeast production obtained by them in fermenting the carbohydrates in spent sulphite liquor from the "zellstoff" factories.

Scarcity of Albuminous Cattle Foods

The problem of obtaining albumen by way of the cultivation of yeast and other micro-organisms is important for Germany where there is a sensible scarcity of albuminous cattle foods. Based on the biological work of Heineberg in which he succeeded in obtaining a highly albuminous yeast on a large scale in a nourishing solution containing molasses and ammonia salts, Delbruck and his co-workers developed the production of yeast through the cultivation of special yeast in a nourishing solution which contained besides molasses only inorganic salts, including ammonium salts as the source of the required nitrogen, during the war. Albuminous cattle food, and in particular the *Torula* kinds, at that time known as "mineral yeasts," were the products obtained, but in 1916, when sugar and molasses had become scarce, the yeast factories erected at considerable cost, had to be closed down. Only in the last 10 years, after the processes for obtaining wood sugar had developed to a semi-commercial stage, and the sources of carbohydrates became more abundant, was there a revived interest in the production of yeast for cattle food.

Albumen Synthesis

In earlier publications, the authors have shown that the biological albumen synthesis through the cultivation of *Torula utilis* in wood sugar solutions with only inorganic salts added to the nourishing solution, was possible. In particular, it was shown that no addition of organic nitrogen, such as is used in molasses fermentation, is needed, to obtain high yields of yeast albumen, and also that the cultures could be maintained pure for many months. From 100 grams of reducing sugar, up to 43 grams of dry yeast substance were obtained, the yeast averaging 57 to 60 per cent. in albumen—more correctly described as raw protein.

From 100 kg. of dry wood substance by the Scholler-Tornesch process, 50 to 55 kg. of reducing sugar, corresponding to 40-43 kg. of fermentable sugar, there was obtained on an average 20 kg. of dry yeast substance, containing 11.8 kg. of yeast albumen. By the Bergius process the wood sugar obtained from 100 kg. of wood yielded 25 kg. of dry yeast substance, containing 14.5 kg. of yeast albumen. According to

more recent experiments by H. Claussen, 54.7 kg. of dry yeast substance have been obtained from 100 kg. of fermentable sugar. This result was due to the gradual adaptation of the *Torula* yeast in the nourishing substratum with only inorganic salt substances, and also the method of oxygen addition by fine aeration through porous ceramic material. From the biological standpoint, it may be stated that no infection of the yeast culture was to be observed after 45 cultivations.

Use of Wood Sugar

Wood sugar has been found to be a suitable substratum for the otherwise inorganic yeast cultivation. These sugars as raw material for the large scale biological albumen production are not yet sufficiently abundant and cheap in Germany, where the wood sugar factories have only the character of experimental plants. The authors, therefore, sought to utilise the spent liquor from the "zellstoff" factories and the waste water from the wood pulp plants, as raw materials for yeast production.

The spent sulphite liquor contains about 2-2.5 per cent. fermentable carbohydrates, besides considerable quantities of lignin sulphonic acid, pentones, etc., which together with the fermentable sugar, make the concentration from 80 to 120 grams per litre. The average content of fermentable sugar is about equal to that in the wort in the Scholler process. It is well known that the fermentable carbohydrates in the sulphite liquor can be fermented by special yeasts to yield alcohol. In order for the fermentation to proceed smoothly, the sulphurous acid must be neutralised, which is effected partly by blowing air through the liquor and partly by the use of lime or chalk, followed by filtration. The yield of alcohol per cubic metre of solution is about 10 litres. In this way there is being obtained in yearly increasing quantities, alcohol from sulphite liquor. According to information given out by the Reichsmontepolverwaltung, the alcohol produced in this way in 1933/34 amounted to 456,515 hectolitres from 5,027,385 cubic metres of sulphite liquor.

Results of Experiments

In the authors experiments, sulphite liquor from the Zellstoff Mannheim-Waldhof was used, containing 2.56 per cent. fermentable, and 3.9 per cent. reducing sugar. Ammonia or ammonium salts were added to bring the total nitrogen up to 110 mg. per litre. As the fermenting agent, a carefully adapted *Torula* yeast which had been cultivated for several months in a wood sugar solution, was used. The process employed was similar to that urged in the compressed yeast industry. The air for aeration was passed through an aggregate of calcined stone which guaranteed very finely divided aeration. The sulphite liquor was treated in the usual manner as for alcohol production, after which the hot liquor was aerated and neutralised by adding lime and chalk, and then filtered. The nourishing salts added were ammonium phosphate, ammonium sulphate, magnesium sulphate, and potassium sulphate. A part of the inorganic addition was added during the

fermentation in the form of a dilute ammonia solution. About 10 per cent. of the total liquor was first placed in the fermenting vat, to which the fermenting yeast was added in the form of a mush. Six to seven hours later the main quantity of the liquor is added to this first lot, and aerated an hour later. The total duration of the cultivation lasts from 6 to 8 hours; through addition of dilute ammonia and carbonate of soda during the fermentation, any free acid developed becomes neutralised, although it is desirable to maintain a slight acid reaction in the liquor. The temperature of fermentation is maintained at 28-30° C.

After fermentation has ceased, the yeast is separated by centrifuging, and the dry yeast substance, the albumen, and nitrogen determined. A part of the yeast is retained for starting fermentation of new batches of liquor, and is best stored in a refrigerator. The yields obtained with 5 successive cultivations from 100 grams of fermentable sugar averaged 51.4 grams of dry yeast substance, containing 23 grams of dry yeast albumen. This yield is very close to that obtained from the wort of the Scholler wood sugar process. The author's experiments are said to show for the first time that sulphite liquor will yield yeast by fermentation without the addition

In the German "zellstoff" factories about 5 million cubic metres of spent sulphite liquor are produced yearly which, by suitable methods, would yield about 200,000 tons of compressed yeast with about 50,000 tons of dry yeast substance, corresponding to about 26,400 tons of yeast albumen. The quantity of sulphite liquor produced in Germany increases considerably year by year. For alcohol production from sulphite liquor only the spent liquor and the first washings are used, while the remaining wash waters with lower carbohydrate content are not treated. The authors suggest that if these wash waters were enriched in carbohydrates by the addition of wood sugar, a further 25,000 tons of yeast per annum could be obtained from this source. There is also the question of utilising for yeast production the waste waters from the wood pulp factories. These are comparatively low in their carbohydrate content, but the problem of their utilisation is being investigated.

The present production of compressed yeast from all sources in Germany has been given by Weiss as 55,000 tons a year. From the German spent sulphite liquors, about 4 times that quantity could be obtained. In comparison to the production of pure yeast in Germany, the above estimate of 200,000 tons is about 10 times as great.

Personal Notes

DR. WALTER T. K. BRAUNHOLTZ, who has been technical assistant secretary of the Institution of Gas Engineers, was last week appointed secretary of the Institution, to succeed Mr. J. R. W. Alexander as from June 21. Dr. Braunholtz was

educated at Greshams School, Holt, and Trinity College, Cambridge. After taking a first-class honours degree in science, he spent three and a half years in post-graduate chemical research, partly under Professor Sir William Pope, F.R.S., and Dr. W. H. Mills, F.R.S., at Cambridge University, and partly under Professor H. Staudinger, at the Federal Technical College, Zurich. He was awarded the degree of



Dr. W. T. K. Braunholtz.

Ph.D., at Cambridge University. Dr. Braunholtz entered the carbonisation industry in North-East England, in which he was actively engaged for twelve years. During this period he was firstly chemist-in-charge of laboratories and research work in connection with a group of collieries and coke-oven plants owned by Pease and Partners, Ltd., in County Durham. Later he was senior chemist to the Northern Coke Research Committee during the first two and a half years of its existence. He returned to Pease and Partners, Ltd., at their invitation, to take charge of all research activities connected with the firm's collieries, coke oven and by-product plant.

MR. JOHN S. BAUCHOP, a director of the United Turkey Red Co., Ltd., opened the Levenbank Bowling Club's green at Jamestown last week.

MR. ROBERT POTTER, Dysart, employed by R. Hutchison and Co., flour millers and maltsters, Kirkcaldy, has been awarded the college medal and certificates in the national certificate course in chemistry, second year, at the Heriot-Watt College, Edinburgh.

MR. P. S. DRINKWATER has been appointed sales manager of the Valor Co., Ltd., in place of Mr. C. W. Jamieson, who has resigned and left their employ.

MR. A. E. ALEXANDER, B.A., of King's College, Cambridge, and Mr. T. P. Hughes, B.A., of Gonville and Caius College, Cambridge, are sharing the 1936 Gordon Wigan prize in chemistry.

MR. A. BEHARRELL, who has recently retired from the post of chief chemist at the Cleveland works of Dorman Long and Co., Ltd., after 50 years' service with the firm has been presented with a wallet of Treasury notes. The presentation was made by Mr. F. Shepherd, general works manager.

MR. F. W. STEEL may shortly sever his connection with the Government Chemical Laboratory at Perth, Western Australia, in order to commence a private practice in Perth as analytical and consulting chemist. Mr. Steel is the present hon. secretary of the Western Australian branch of the Australian Chemical Institute.

THE AMERICAN SECTION of the Society of Chemical Industry announces the election of the following officers for the year 1937-38: Chairman, James G. Vail; vice-chairman, Wallace P. Cohoe; honorary secretary, Cyril S. Kimball; honorary treasurer, J. W. H. Randall. The following new committee members were elected to take the place of retiring members: W. W. Winship, P. K. Frolich, F. D. Snell, F. A. Lidbury, and G. M. Norman.

THE following elections were made at a meeting of the Board of the Institute of Physics on May 5:—Fellows: N. R. Davis, R. G. J. Fraser, W. Lethersich, W. Mandell, C. W. G. Ockelford, W. L. Patrick, H. Rakshit, O. A. Saunders, and J. R. Scott. Associates: A. H. Cockett, I. Davies, K. A. Gough, A. Hunter, S. N. Ray, R. H. Rowse, H. R. Sarna, R. Stone, N. E. Wild, H. Wilman, H. P. Woods, and E. C. Williams. Registered students: L. J. C. Connell, I. G. Davies, P. Ingleby, G. S. Monteith, E. V. Stokes, and M. C. K. Tweedie.

THE EARL OF HAREWOOD will propose the toast of the Boys' Hostels' Association at the banquet on June 24, to be held by invitation of the Lord Mayor at the Mansion House, London. Sir Robert Horne will submit the toast of "The Young Citizen," to which Mr. John T. Christie, the new Headmaster of Westminster, will reply. Other speakers include Lord Portal, representing the Jubilee Trust, Mr. Norman Birkett, K.C., Lord Leverhulme, and Sir Ernest Benn. The Lord Mayor will preside. This is the first banquet of the Association since the opening of King George's House, Stockwell.

The Birth and Growth of Imperial Chemical Industries, Ltd.

Tenth Anniversary Retrospect

LAST December marked the tenth anniversary of the formation of Imperial Chemical Industries, Ltd. In a special celebration number of the "I.C.I. Magazine," published this week, Lord McGowan, chairman of the company, describes the circumstances in which it was formed, and reviews its history during the ten years.

There was one consideration which outweighed all the others in bringing about the combination of the four merging companies. Before the war this country, except in the case of the heavy chemical industries, occupied a small place in world chemical manufacture. The war, more than anything else, emphasised the importance of the creation and maintenance of a strong British chemical industry. It receives a measure of protection from the Dyestuffs Act of 1920 and the Safeguarding of Industries Act of 1921; but when they looked at this country's position and compared it with that of competitors abroad, especially in the United States and Germany, the directors were bound to consider the possible menace which the combined forces of the chemical industries in those countries would present in the world's markets unless they too pooled their resources. They realised that, if the British chemical industry were to survive, it was imperative that there should be one organisation capable of presenting a united front on all questions of major importance and of meeting corresponding groups in foreign countries on equal terms.

A Record Authorised Capital

The company was formed with an authorised capital of £65,000,000, the biggest initial capital in the annals of company registration in England, being equivalent to half a normal year's total registrations. Stamp duty amounting to £650,000 had to be paid. The authorised capital was increased in 1928 to £75,000,000 and again in 1929 to £95,000,000, at which figure it now stands. The issued capital at December 31, 1936, amounted to £71,927,679.

No time was lost in putting the merger into operation, but, since the staffs of the various companies and departments were scattered all over London and elsewhere, the difficulties inseparable from the starting of such an enterprise were not lessened and the housing of the head office staff was one of the first tasks. At that time the Millbank site, which, during the war and subsequently, had been occupied by temporary Government offices, was available, and thanks to the energy with which the late Sir Frank Baines, the architect, attacked the problem, the present offices, which normally would have taken some five years to build, were ready in a little over two years; by February 9, 1929, the head offices were installed at Imperial Chemical House.

Within a year of the occupation of Imperial Chemical House, Lord Melchett died. His reputation was international and his loss to the chemical industry as a whole incalculable.

A Policy of Rigid Centralisation

At the outset a policy of rigid centralisation was pursued. It was believed that only in this way could manufacture, sales, finance, purchasing, research and labour policy be co-ordinated throughout the whole organisation. Intensive centralisation was also essential for the study of the many-sided problems arising from separate ownership. One of the first efforts towards consolidation was in the field of production. The board had to consider the lowering of costs by the concentration of manufacture and by reconsidering the suitability of existing plant situations as distributing centres for the home and export market. This and innumerable other problems had to be studied in detail; they could only be so studied under a strong central control.

A period of decentralisation began with the creation of the group system in 1931; this involved the investing of their delegate boards with authority to deal with all the ordinary problems arising in their own fields. This delegation of authority continued right along the management line. After six years' working the groups, by their efficiency and successful results, have justified the trust placed in them by the main board.

Petrol from Coal

After referring to many new I.C.I. products, Lord McGowan says that perhaps the most striking of all achievements, and the one which is most before the public eye, has been the successful commercial exploitation of the hydrogenation process of manufacturing petrol from coal. Just before the war, this process had become an academic possibility in Germany through the researches of Dr. Bergius. The I.G. Farbenindustrie, applying this discovery to the treatment of brown coal, were able in 1927 to embark on their big works at Leuna. The Billingham group of I.C.I. began in a modest way in 1927 to tackle the application to bituminous coal, there being no brown coal in this country—a problem very different from the one being developed in Germany—and continued for two years on a relatively small scale. At this stage it became necessary to erect a semi-commercial plant which could treat 15 tons of coal per day and which worked on and off for several years.

The legislation which made a full-scale project a justifiable enterprise was the British Hydrocarbon Oils Production Act of 1934. This measure, which was first announced in July, 1933, guaranteed the continuance of a protection on home-produced spirit.

In the spring of 1936, the company obtained a full interest in Nobel Chemical Finishes, Ltd., and at the beginning of this year Mouldrite, Ltd., became a fully owned subsidiary. Following the policy of establishing local factories abroad where it is economically sound to do so and of developing the national resources of the Empire, the company's interests overseas have steadily increased and show signs of even further expansion.

Widespread use of I.C.I. Products

There is to-day practically no industry and no product made by man in which some use for chemicals manufactured by I.C.I. cannot be found; its work is a public service designed to supply the needs of the community in the most efficient and effective manner. It has to consider the effect of its policy upon employee, consumer and shareholder and has always to be mindful of their different interests. Such a task demands an organisation which is capable of harmonising these interests and which is at the same time flexible enough to meet the changing conditions of world commerce.

"Every member of the board," says Lord McGowan, realises in his turn how impossible would have been our task had we not had the support and loyalty of our staff and workers of every rank. The knowledge that there has grown up in these ten years throughout the company a spirit of mutual understanding and willing service causes me, perhaps more than any other factor, to look to the past with pride and to the future with a deep-rooted confidence."

MR. JOSHUA ALFRED DAVY, of Bispham, Blackpool, and formerly of Crigglesstone, near Wakefield, general manager of Benzol and By-Products, Ltd., left estate valued £11,237, with net personality £6,628.

The Coronation Honours List

Peerage for Sir John Cadman

THE Coronation Honours List, published on Tuesday, the eve of the Coronation of King George VI and Queen Elizabeth, included a number of names of interest in the chemical industry. The most important was a barony conferred upon Sir John Cadman, G.C.M.G., D.Sc., D.Litt., D.Eng., M.Inst.C.E., chairman of the Anglo-Iranian Oil Co., Ltd., and the Irak Petroleum Co., Ltd. He is well known as one of the world's leaders on mining and oilfield questions, and holds several important Government consultative appointments. He is a past president of the Institute of Fuel, the Society of British Gas Industries and the Institution of Petroleum Technologists. He has recently been concentrating on Trinidad as an Empire source of petroleum.

Dr. E. Leslie Burgin, M.P. for Luton since 1929, and Parliamentary Secretary to the Board of Trade since 1932, has been appointed a member of the Privy Council. He is well known to members of the chemical industry and a frequent speaker at social functions held by the various trade associations. As recently as last month he was expected to attend the luncheon of the British Chemical and Dyestuffs Traders' Association, but was detained at the Sugar Conference then in progress.

Among the newly created baronets are Sir David Milne-Watson, I.L.B., D.L., and Sir William Edge, J.P. Sir David Milne-Watson is governor of the Gas Light and Coke Co.,

Regiment (The Rangers). During the war he was chairman of the Hospitals Supplies Committee, and was a member of the Government Committee on Housing. He is chief of the Scottish Clans Association in London, and is a keen angler, and an expert shot.

Sir William Edge is associated with the dyestuff manufacturing firm of William Edge and Sons, Ltd., of Bolton and Glasgow. He has been M.P. for the Bosworth division of Leicestershire since 1927. For seven years from 1916 he was



Sir David Milne-Watson, governor of the Gas Light and Coke Co., who has been created a baronet.

president of the National Gas Council, chairman of the National Joint Industrial Council for the Gas Industry, president of the National Benzole Association, chairman of the Federation of Gas Employers, president of the British Road Tar Association, and chairman of the British Sulphate of Ammonia Federation. Educated at Edinburgh, Paris, Marburg, and Oxford, Sir David was called to the Bar in 1896. He contested S.E. Essex in 1895. Sir David has been interested in the Territorial Army and recruiting for many years, and is Hon. Colonel of the 12th Battalion London



Dr. Robert H. Pickard, president of the Institute of Chemistry, was among new knights announced in the Coronation Honours List.

Member for Bolton; he was a Junior Lord of the Treasury from 1919 to 1922. Since 1931 he has sat in Parliament as a Liberal National.

A knighthood has been conferred upon Dr. Robert Howson Pickard, D.Sc., Ph.D., F.R.S., F.I.C., director of the British Cotton Industry Research Association at Shirley Institute, Didsbury, Manchester. Dr. Pickard was president of the Society of Chemical Industry in 1933, and is at present president of the Institute of Chemistry. One of his most arduous offices to-day is that of chairman of the Chemical Council, which was appointed in 1935 to bring about closer co-operation between the Chemical Society, the Institute of Chemistry, and the Society of Chemical Industry. He went to Manchester in 1927 from the Battersea Polytechnic, of which institution he was principal from 1920 to 1927. In addition to the responsibilities of that post he acted as director of research for the British Leather Manufacturers' Association. He has served on the councils of the British Launderers' Research Association and the Boot and Shoe Research Association, and on the Adhesives Committee of the Department of Scientific and Industrial Research. Dr. Pickard was formerly head of the chemical department of the Blackburn Municipal Technical College from 1899 until his appointment as principal of the college in 1905, a post which he held for 15 years. He was chairman of the Manchester section of the Society of Chemical Industry from 1929 to 1931.

A knighthood was conferred upon Mr. Thomas William Miller-Jones, managing director of Thomas Hill-Jones, Ltd. Mr. Miller-Jones has been associated with the company for forty years, and has served on many committees for the improvement of the conditions of the poor people of the East End. The honour has been bestowed upon him for political and public services.

Mr. J. W. NAPIER, M.I.Chem.E., chairman of the Glasgow Section of the Society of Chemical Industry, has received the M.B.E.

Mr. Hugh N. Linstead, secretary and registrar of the Pharmaceutical Society, has received the O.B.E.

Mr. Horace A. S. Townshend, warden of the John Benn Hostel at Stepney, has received the M.B.E., a well deserved recognition of his work among the boys of the East End.

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From Week to Week

AMERICANS HAVE INVESTED ABOUT £1,500,000 in a copper enterprise in Namaqualand, where the largest base metal smelting plant in South Africa is to be erected. It is expected that 50 tons of pure copper will be mined daily at the start.

LIQUID HELIUM was recently obtained in the Soviet Union from a helium liquifier designed by Professor P. L. Kapitsa and installed in his Institute of Physics in Moscow. Professor Kapitsa is now designing another helium liquifier with a capacity of nine litres per hour.

THE RED CLIFFS AT BUDLEIGH SALTERTON, Devon, may provide a new source of radium. White nodules, suggestive in appearance of a fungoid growth, have been found in the cliffs, and an examination by the Crystallography Laboratory, Cambridge, appear to contain uranium.

HOWARDS AND SONS, LTD., have printed some notes on lactates and gluconates for distribution to users of these products. Until recently users have been largely dependent upon foreign sources for their supplies, but supplies of British manufacture are now obtainable.

A REPRESENTATION has been made to the Board of Trade under Section 10(5) of the Finance Act, 1926, for the exemption of hydroxy ethyl cellulose from Key Industry Duty. Any communications should be addressed to the Principal Assistant Secretary, Industries and Manufactures Department, Board of Trade, Great George Street, London, S.W.1, not later than June 5.

THE EXPERIMENTAL PLANT of the Leningrad Institute of Research in Synthetic Liquid Fuels and Gas has produced a gas generator for the production of concentrated furnace gas. The generator was designed by the Soviet engineer, N. I. Grachev. Its efficiency in the production of concentrated gas is said to be ten times as great as the ordinary gas generators working on anthracite.

THE BRITISH STANDARDS INSTITUTION will hold its annual meeting at the Dorchester Hotel, Park Lane, on June 8, followed by a luncheon. Emphasis is this year being laid on the value of Empire unification in matters of standardisation and it is hoped that several distinguished representatives of the Dominions will be present at the luncheon. Members are reminded that an early application for tickets is desirable.

GENERAL REFRACTORIES, LTD., announces that total sales for March constituted a record. The weight of firebricks, insulating bricks and sands despatched constituted three further records, a record for the number of orders received in one day was established, and the value of goods exported was higher than that in any previous month. April sales were more than 7 per cent. in excess of those for March.

THE "ACHEMA ANNUAL, 1937," will be published at the middle of May. This profusely illustrated book (388 pages) will review with practically no omission the many products for scientific and industrial purposes of the German Chemical Apparatus and Plant Building Industry as these products will be shown at the Achema VIII Chemical Engineering Exhibition. This exhibition will be held at Frankfurt-on-Main, July 2-11, on the occasion of the National Convention of German Chemists.

A REORGANISATION SCHEME for the whole Unilever group, which may result in increased dividends for shareholders, was broadly outlined by Mr. F. D'Arcy Cooper at the company meeting on May 5. The scheme—which is expected to be completed before the end of the year—provides for the amalgamation of Unilever, Ltd., and Lever Brothers, and for redistribution of the group's shareholdings, so that the merger company will hold only British Empire interests and Unilever N.V. all other interests.

NO ACCEPTABLE OFFERS have been received for the purchase of the coal-oil plant at Seaham belonging to Coal and Allied Industries, Ltd., London, and the last day for submitting tenders has expired. Mr. Geoffrey Bostock, the receiver, is to carry on negotiations with interested firms with a view to the disposal of the plant as a going concern, and if these are not brought to a successful close the plant may be sold in lots. The works cover an area of 49 acres and formerly employed 750 men. Mr. Bostock is acting on behalf of the debenture holders.

MR. PHILIP E. HILL announced at the annual meeting of Beechams Pills, Ltd., on May 7, that the company was building for the Royal Northern Hospital the Beecham Laboratory—and in addition had agreed to contribute annually to the cost of its upkeep. In consideration of this, the hospital pharmacist, Mr. Herbert Skinner, a past president of the Pharmaceutical Society, had agreed continuously to review the formulae of the company's various proprietary medicines and bring them into line with the latest discoveries of medical research.

COMPANY MEETING.

Beechams Pills, Ltd.

High Record in Profit—Larger Distribution—

Mr. Philip Hill's Speech

THE Ninth Ordinary General Meeting of Beechams Pills, Ltd., was held at the Hotel Victoria, Northumberland Avenue, W.C., on Friday, May 7.

MR. PHILIP E. HILL (chairman of the company), who presided, said:—Ladies and gentlemen,—Is it agreed that the report and accounts be taken as read? (Agreed.) The profits, amounting to £541,000 odd, show an increase over those of last year of £115,000 and establish a new record for the company. Again, this result is attributable to the development of our home trade, and once more we have every reason to believe that we shall experience a further expansion during the coming year.

Development of Overseas Business

As stated at our last annual meeting, we are strenuously attacking the development of our overseas business, and during the year representatives of the company have visited Australia, New Zealand, India, U.S.A., Canada, Egypt, Palestine, Colombo, Cuba, West Indies, and the Bahamas. It is, of course, much too early to talk of revenue from this source, but the views I expressed with regard to the possibilities of this when I last had the pleasure of meeting you have been considerably strengthened by what I myself have seen, and from reports received, and it is possible that the directors may consider it desirable to form an overseas company. In such an event the shareholders in this company will be given the opportunity, if they so desire, of providing any new capital that may be required for this purpose.

Our allocation for general advertising and business propaganda during the year is the largest in the history of the company, but what is more to the point is that it has been well spent—as is evidenced by the large increase in the company's profits.

The Beecham Laboratory

I have always held the view that in a business such as ours the best reserve we can have is in our advertising and business propaganda. In this direction we have this year broken new ground. We are building for the Royal Northern Hospital the Beecham Laboratory—and in addition have agreed to contribute annually to the cost of its upkeep. In consideration of this, their pharmacist, Mr. Herbert Skinner, a past president of the Pharmaceutical Society, has agreed continuously to review the formulae of our various proprietary medicines and bring them into line with the latest discoveries of medical research. Apart altogether from assisting a very deserving institution, I think we have taken a very definitive step forward in endeavouring to place proprietary articles and medicines on a higher plane with, I am sure, beneficial results to all concerned.

Your directors are pleased to be able to recommend payment of an increased dividend and distribution of a larger bonus. For this I think we owe a very deep debt of gratitude to our working directors and to our managers and staff. I think it is clearly shown that the consideration we have given and are giving them is producing very satisfactory results, and will encourage them to do even better in the future.

Taxation Reserve

You will see that we have this year found a new home for money. I refer to the allocation of £50,000 to special taxation reserve. We understand that no additional tax will be payable for the past year and you will see, therefore, that the £50,000 we have allocated to the special reserve is in respect of the possible liability for next year ending March 31, 1938. We think that this amount is far in excess of what we shall be called upon to pay, but of course it depends upon the amount of profits we are able to earn. Until we have had a chance of seeing the formulae of the new Budgetary bill, it is, of course, impossible to form any definite conclusions about it, but I am sure we shall all be very happy to contribute our share towards a matter of such vital importance to our nation.

In calmer moments one can only sympathise with the Chancellor in a very difficult and unpleasant task and hope his financial formula, when produced, will be as popular as that of Beechams Pills—which, after a life of nearly 100 years, have proved themselves to be worth more than "A guinea a box." (Laughter and applause.)

The Chairman concluded by moving the adoption of the report and accounts, which was seconded by Mr. Louis Nicholas (vice-chairman), and carried unanimously.

The proceedings terminated with a hearty vote of thanks to the chairman and directors, and to the staffs of the various companies.

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

IMPREGNATING SOLUTIONS FOR WOOD and other materials.—Bolidens Gruvaktiebolag. Oct. 22, 1935. 125/36.
POLYMERISATION OF OLEFINS.—Standard Oil Development Co. Oct. 26, 1935. 13861/36.
MANUFACTURE OF PIGMENT DYESTUFFS of the phthalocyanine series.—I. G. Farbenindustrie. Oct. 23, 1935. 28202/36.
MANUFACTURE OF VAT DYESTUFFS of the anthraquinone series.—I. G. Farbenindustrie. Oct. 22, 1935. 28431/36.
MANUFACTURE OF MONOAZO DYESTUFFS.—I. G. Farbenindustrie. Oct. 22, 1935. 28432/36.
MANUFACTURE OF OXYGENATED ORGANIC COMPOUNDS.—E. I. du Pont de Nemours Co. Oct. 22, 1935. 28671/36.
MANUFACTURE OF ARTIFICIAL MASSES from polyvinyl halides.—I. G. Farbenindustrie. Oct. 26, 1935. 28723/36.
PROCESS FOR THE MANUFACTURE OF ALKYL DERIVATIVES of aminated aromatic hydrocarbons.—U.S. Industrial Alcohol Co. Oct. 22, 1935. 28730/36.
PROCESS FOR THE MANUFACTURE OF HYDROXY ACIDS and unsaturated acids of the cyclopentanophenanthrene series.—Schering-Kahlbaum A.-G. Oct. 24, 1935. 28905/36.
PROCESS FOR THE EXTRACTION OF LIQUID MIXTURES.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Oct. 26, 1935. 29107/36.
MANUFACTURE OF ORGANIC CONDENSATION PRODUCTS.—E. I. du Pont de Nemours and Co. Oct. 26, 1935. 29114/36.
MANUFACTURE OF CATALYSTS FOR ORGANIC SYNTHESIS.—E. I. du Pont de Nemours and Co. Oct. 26, 1935. 29115/36.

Specifications Accepted with Date of Application

MANUFACTURE OF SHEETS OR FILMS OF POLYMERISATION PRODUCTS. Deutsche Celluloid-Fabrik. Nov. 1, 1934. 464,287.
PROCESS FOR THE MANUFACTURE OF AZO DYESTUFFS on the fibre.—A. Carpmal (I. G. Farbenindustrie.) Oct. 17, 1935. 464,211.
HEAT TREATMENT OF METALS.—J. E. Malam, and Imperial Chemical Industries, Ltd. Oct. 17, 1935. 464,325.
PREPARATION OF ESTERS.—Carbide and Carbon Chemicals Corporation. Oct. 26, 1934. 464,427.
PRODUCTION OF MAGNESIUM BY THE THERMAL REDUCTION OF MAGNESIFEROUS RAW MATERIALS.—I. G. Farbenindustrie. Feb. 28, 1935. 464,438.
MANUFACTURE AND PRODUCTION OF VAT DYESTUFFS.—G. W. Johnson (I. G. Farbenindustrie.) Nov. 6, 1935. 464,299.
MANUFACTURE OF VERY THIN SHEETS from polymerised organic compounds.—Deutsche Celluloid-Fabrik. Dec. 15, 1934. 464,302.
DISTILLATION.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. March 20, 1935. 464,307.
PRODUCTION OF HYDROCARBONS.—G. W. Johnson (I. G. Farbenindustrie.) April 3, 1936. 464,308.
PURIFICATION OF CRUDE PHOSPHORIC ACID.—Pulverfabrik Skodawerke-Wetzlar, A.-G. April 30, 1935. 464,370.
REMOVAL OF ASPHALIC SUBSTANCES AND PARAFFIN WAX from petroleum or petroleum products.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 1, 1935. 464,175.
PRODUCTION OF WORKABLE PAINTS having a low content of oil.—T. Goldschmidt, A.-G. June 28, 1935. 464,240.
APPARATUS FOR THE PRODUCTION OF SYNTHETIC HYDROCARBONS.—Mannesmannrohren-Werke and Ruhrchemie, A.-G. June 26, 1935. 464,242.
MANUFACTURE OF BORON CARBIDES.—Dr. A. Wacker Ges. Fur Elektrochemische Industrie, Ges. Sept. 17, 1935. 464,182.
MEANS FOR SUPPLYING GAS FOR THE CHLORINATION OR SIMILAR TREATMENT OF LIQUIDS.—Wallace and Tiernan Co., Inc. Oct. 31, 1934. 464,326.
LUBRICATING OILS.—Ruhrchemie, A.-G. July 10, 1935. 464,468.
PROCESSES FOR RENDERING WOOL MATERIAL UNSHRINKABLE.—A. J. Hall, W. N. Hickling, and S. J. Pentecost. July 17, 1935. 464,503.
FERMENTATION OF BEET MOLASSES.—Commercial Solvents Corporation. July 30, 1934. 464,755.
DYEING OF CELLULOSE ESTERS AND ETHERS.—H. Blackshaw, M. A. T. Rogers, and Imperial Chemical Industries, Ltd. Aug. 14, 1935. 464,511.
TREATMENT OF TEXTILES.—G. W. Johnson (I. G. Farbenindustrie.) Aug. 17, 1935. 464,756.
RESINOUS PRODUCTS DERIVED FROM DERIVATIVES OF DIPHENYLMETHANE.—Rohm and Haas Co. Oct. 27, 1934. 464,762.
TANNING.—Monsanto Chemicals, Ltd., and G. W. Gladden. Oct. 18, 1935. 464,766.
MANUFACTURE AND APPLICATION OF COLOURED PIGMENTS.—I. G. Farbenindustrie. Oct. 19, 1934. 464,638.
TRANSFERENCE OF LIQUID EXPLOSIVES.—W. A. P. Challenor, G. A. Scott, and Imperial Chemical Industries, Ltd. Oct. 21, 1935. 464,642.

MANUFACTURE OF POLY-AZO-DYESTUFFS.—A. Carpmal (I. G. Farbenindustrie.) Oct. 23, 1935. 464,827.
INSECTICIDAL COMPOSITIONS.—Grasselli Chemical Co. Oct. 24, 1934. 464,776.
MANUFACTURE OF PLASTIC MASSES.—I. G. Farbenindustrie. Oct. 26, 1934. 464,783.
RUBBER COMPOSITIONS.—I. G. Farbenindustrie. Oct. 24, 1934. 464,791.
PROCESS FOR THE MANUFACTURE OF CAUSTIC SODA.—I. L. Clifford, and Imperial Chemical Industries, Ltd. Oct. 24, 1935. 464,834.
MANUFACTURE OF TEXTILE MATERIALS.—R. R. H. Brown, J. M. Cooper and Imperial Chemical Industries, Ltd. Oct. 24, 1935. 464,792.
MANUFACTURE OF AROMATIC CARBOXYLIC ACID CHLORIDES.—W. W. Groves (I. G. Farbenindustrie.) Oct. 25, 1935. 464,797.
BLENDED PIGMENTS.—Krebs Pigment and Color Corporation. Oct. 30, 1934. 464,836.
MANUFACTURE AND PRODUCTION OF SHAPED ARTICLES from polymerised vinyl carbazole.—G. W. Johnson (I. G. Farbenindustrie.) Oct. 29, 1935. 464,808.
PROCESS FOR THE MANUFACTURE OF HIGHLY ACETYLATED CELLULOSE.—L. S. E. Ellis (P. Koetschet.) Oct. 29, 1935. 464,843.
PREPARATION OF ARTIFICIAL ASPHALTS.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. April 3, 1935. 464,653.
OXIDATION OF AMMONIA with oxygen or gases containing oxygen and a contact mass therefor.—H. D. Elkington (Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij). Dec. 13, 1935. 464,706.
RECOVERY OF VOLATILE SOLVENTS in extraction plants for oils and fats.—E. Potter (Montecatini Soc. Generale per l'Industria Mineraria ed Agricola). Feb. 20, 1936. 464,526.
MANUFACTURE OF AMINO-CARBOXYLIC ACIDS of capillary action.—W. W. Groves (I. G. Farbenindustrie.) Sept. 21, 1935. 464,657.
MANUFACTURE OF ACID AMIDES substituted at the nitrogen atom. Soc. of Chemical Industry in Basle. March 22, 1935. 464,530.
MANUFACTURE OF SULPHONAMIDE-ALDEHYDE condensation products.—Fahlberg-List, A.-G., Chemische Fabriken. May 21, 1935. 464,660.
PROCESSES AND APPARATUS FOR THE PURIFICATION OF JUICES and the treatment of solutions by contact with a gas.—E. J. Hugel. May 15, 1935. 464,538.
PRODUCTION OF STARCH PASTES.—W. Seck. May 31, 1935. 464,606.
CLOSURES FOR CONTAINERS FOR MEDICAMENTS.—Winthrop Chemical Co., Inc. April 3, 1936. 464,546.
OXYGEN RESCUE APPARATUS.—I. G. Farbenindustrie. Nov. 27, 1935. 464,571.
METHOD OF PRODUCING HYDROGEN by converting carbon monoxide with steam.—Oesterreichisch Amerikanische Magnesit, A.-G. Oct. 23, 1935. 464,667.
PRODUCTION OF VALUABLE HYDROCARBONS by selective polymerisation of olefinic hydrocarbons.—A. L. Mond (Universal Oil Products Co.). Oct. 17, 1935. 464,671.
PROCESS FOR EFFECTING CHEMICAL REACTIONS of olefinic hydrocarbons.—A. L. Mond (Universal Oil Products Co.). Oct. 17, 1935. 464,672.
ALKYLATION OF AROMATIC COMPOUNDS.—A. L. Mond (Universal Oil Products Co.). Oct. 17, 1935. 464,752.
CATALYTIC REFINING TREATMENT OF HYDROCARBON DISTILLATES.—A. L. Mond (Universal Oil Products Co.). Oct. 17, 1935. 464,753.
MANUFACTURE OF COLOURING MATTERS.—M. Wyler, and Imperial Chemical Industries, Ltd. July 8, 1936. 464,673.

Applications for Patents

MANUFACTURE OF MAGNESIUM-TITANIUM-SPINELL.—Titanges. (Germany, April 7, '36.) 9903.
CONVERSION OF ALIPHATIC HYDROCARBONS.—Universal Oil Products Co. (United States, Sept. 30, '36.) 9398, 9587.
SEPARATING NITRILE-HYDROCARBON MIXTURE.—Armour and Co. (United States, July 9, '36.) 10269.
PREPARING POLYMERISED NITRILES.—Armour and Co. (United States, July 27, '36.) 10270.
SEPARATING NITRILE-HYDROCARBON MIXTURES.—Armour and Co. (United States, Sept. 14, '36.) 10271.
PREPARING LIQUID XYLHEPTADEYL KETONES.—Armour and Co. (United States, Oct. 8, '36.) 10272.
PRODUCTION OF ARTIFICIAL RUBBER.—R. H. A. M. Bamberger. (France, April 11, '36.) 10355.
MANUFACTURE OF A STABLE LIQUID VITAMIN-CONTAINING PREPARATION.—F. E. Bibbins. 10169.
MANUFACTURE OF RUBBER COMPOSITIONS, etc., from aqueous dispersions of rubber.—A. S. Carpenter. 10112.
MANUFACTURE OF FIBRES, etc., from cuprammonium cellulose solutions.—A. Carpmal (I. G. Farbenindustrie.) 10059.
MOLTEN INORGANIC SALT BATHS FOR CHILLING HEATED GLASS.—Corning Glass Works. (June 30, '36.) (United States, Sept. 24, '35.) 10192.

- MANUFACTURE OF ETHERS.—A. Carpmal (I. G. Farbenindustrie.) 10304.
- VULCANISATION PROCESSES.—A. Carpmal (I. G. Farbenindustrie.) 10538.
- MANUFACTURE OF POLYPHOSPHATES.—H. and E. Albert Chemische Werke vorm. (Germany, April 8, July 10, '36.) 9997-10002.
- MANUFACTURE, ETC., OF METAL DERIVATIVES OF HYDROXY COMPOUNDS.—Deutsche Hydrierwerke, A.-G. (Germany, April 9, '36.) 10211.
- MANUFACTURE, ETC., OF METAL DERIVATIVES OF HYDROXY COMPOUNDS.—Deutsche Hydrierwerke, A.-G. (Germany, May 27, '36.) 10212.
- PROCESS OF MAKING COLLOIDAL ALKALINE EARTH CARBONATE.—Diamond Alkali Co. (United States, April 18, '36.) 10173.
- PROCESS OF MAKING COLLOIDAL ALKALINE EARTH CARBONATE.—Diamond Alkali Co. (United States, Nov. 30, '36.) 10174.
- REDUCTION OF SULPHUR DIOXIDE TO ELEMENTAL SULPHUR.—V. F. Feeny (Consolidated Mining and Smelting Co. of Canada, Ltd.). 10608.
- MANUFACTURE OF DIETHYLCARBAMATES OF RESORCINOL-MONO-ALKYL ETHERS OR HOMOLOGUES OR ANALOGUES THEREOF.—W. W. Groves (I. G. Farbenindustrie.) 10152.
- MANUFACTURE OF AZO-DYESTUFFS SOLUBLE IN WATER.—W. W. Groves (I. G. Farbenindustrie.) 10150.
- MANUFACTURE OF MONO-AZO DYESTUFFS SOLUBLE IN WATER.—W. W. Groves (I. G. Farbenindustrie.) 10151.
- PROTECTIVE CASINGS FOR GOODS SENSITIVE TO LIGHT AND AIR.—W. W. Groves (I. G. Farbenindustrie.) 10504.
- MANUFACTURE OF VAT DYESTUFFS OF THE ANTHRAQUINONE SERIES.—W. W. Groves (I. G. Farbenindustrie.) 10622.
- INSECTICIDES.—I. G. Farbenindustrie. (Germany, April 11, '36.) 10149.
- MANUFACTURE OF MONO-AZO-DYESTUFFS.—I. G. Farbenindustrie. (Germany, April 11, '36.) 10371.
- DISINTEGRATION OF VEGETABLE FIBROUS MATERIALS.—I. G. Farbenindustrie. (Germany, May 13, '36.) 10372.
- MANUFACTURE OF OILY MATERIALS.—Imperial Chemical Industries, Ltd. 10413.
- DYEING FURS, ETC.—Imperial Chemical Industries, Ltd., and M. Mendoza. 10651.
- MANUFACTURE, ETC., OF WETTING AGENTS.—G. W. Johnson (I. G. Farbenindustrie.) 10213.
- RECOVERY OF SULPHUR DIOXIDE.—G. W. Johnson (I. G. Farbenindustrie.) 10215.
- MANUFACTURE, ETC., OF AZO DYESTUFFS.—G. W. Johnson (I. G. Farbenindustrie.) 10363.
- RECOVERY OF AMMONIA FROM USED CUPRAAMMONIUM ARTIFICIAL SILK PRECIPITATION LIQUORS.—I. G. Farbenindustrie. (Germany, April 11, '36.) 10422.
- RECOVERY OF POLYNUCLEAR COMPOUNDS.—G. W. Johnson (I. G. Farbenindustrie.) 10364.
- PROTECTIVE AGENTS FOR METALLIC SURFACES.—G. W. Johnson (I. G. Farbenindustrie.) 10666.
- MANUFACTURE, ETC., OF DYESTUFFS.—G. W. Johnson (I. G. Farbenindustrie.) 10667.
- MANUFACTURE OF INTERMEDIATES FOR DYES.—Kodak, Ltd. (Eastman Kodak Co.). (Aug. 15, '35.) 9993.
- MANUFACTURE OF DYES.—Kodak, Ltd. (Eastman Kodak Co.). 9994, 9995.
- MANUFACTURE OF INTERMEDIATES FOR DYES.—Kodak, Ltd. (Eastman Kodak Co.). 10137.
- MAKING ACTIVATED SUBSTANCES SUCH AS VITAMINS.—Kodak, Ltd. (Eastman Kodak Co.). 10550.
- PREPARING HEXYRESORCIN SULPHONIC ACIDS AND SALTS THEREOF.—H. Legerlotz. (Austria, April 9, '36.) 10224.
- MANUFACTURE OF A STABLE LIQUID VITAMIN-CONTAINING PREPARATION.—E. Lilly and Co., E. C. Kleiderer, H. W. Rhodehamel, and E. H. Stuart. 10167, 10168, 10169.
- POLYVINYL ACETAL RESINS.—H. E. Potts (Carbide and Carbon Chemicals Corporation). 10164.
- FUEL OILS.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). 10248.
- PRODUCTION OF HYDROCARBONS BY TREATMENT WITH HYDROGENATING GASES.—H. E. Potts (Carbide and Carbon Chemicals Corporation). 10326.
- PREPARING RUBBER HYDROHALIDES.—Reynolds Research Corporation. (United States, April 24, '36.) 10124.
- RENDERING PAPER, ETC. IMPERMEABLE TO ALCOHOL, ETC.—C. V. Rognone. 10335.
- RUBBER DERIVATIVES.—Rubber Producers' Research Association, and J. W. Barrett. 10353.
- PURIFICATION OF GASES FROM SULPHUR.—A. Ryner. 10547.
- MANUFACTURE OF INTERMEDIATE PRODUCTS.—Soc. of Chemical Industry in Basle. (Switzerland, April 9, '36.) 10144.
- MANUFACTURE OF INTERMEDIATE PRODUCTS.—Soc. of Chemical Industry in Basle. (Switzerland, April 8.) (Cognate with 10144.) 10145.
- MANUFACTURE OF DERIVATIVES OF AZO-DYESTUFFS.—Soc. of Chemical Industry in Basle. (Switzerland, April 9, '36.) 10146.
- MANUFACTURE OF DERIVATIVES OF AZO-DYESTUFFS.—Soc. of Chemical Industry in Basle. (Switzerland, April 8.) (Cognate with 10146.) 10147.
- PRODUCING COLOURED MASSES.—Soc. of Chemical Industry in Basle. (Switzerland, April 9, '36.) 10148.
- MANUFACTURE OF HYDROCARBONS FOR USE IN MOTOR-FUEL BLENDS.—Universal Oil Products Co. (United States, Oct. 16, '36.) 10023.
- CONVERSION OF HYDROCARBON OILS.—Universal Oil Products Co. (Feb. 17, '36.) (United States, Feb. 18, '35.) 10238.

Chemical and Allied Stocks and Shares

AS a result of holiday influences business in the stock and share markets declined this week, and the general tendency was to rather lower prices. The better undertone which developed recently was still in evidence nevertheless, and the lower prices were attributed largely to absence of demand. Selling pressure was reported to be moderate.

Various shares of companies in the chemical and kindred trades moved in favour of holders on balance for the week, despite the fact that best prices have not been held. Imperial Chemical are 38s. 4½d. compared with 37s. 6d. a week ago, and United Molasses 31s. 6d., compared with 29s. 7½d., while Borax Consolidated have improved 9d. to 31s. 9d. The market is still taking the view that there seem reasonable prospects of the latter company being able to increase its dividend over the 7½ per cent. rate which was forthcoming for the past year, and it is being pointed out that at their present price the shares offer a relatively favourable yield.

Distillers were strong with a rise on the week from 114s. to 116s. This reflects renewed hopes in the market that in respect of the financial year ending this month there may either be an increase in dividend or the long-hoped-for share bonus. Last year's 20 per cent. dividend was well covered, as earnings on the ordinary shares were equal to fully 27 per cent., but at the subsequent meeting the chairman referred to the wisdom of dealing conservatively with profits despite the company's strong position.

Boots Pure Drug have lost 1s. 6d. to 52s. on the non-confirmation of market hopes of a scrip bonus. Nevertheless, the increased profits and the maintenance of the cash distribution created a favourable impression, and it is realised that the balance sheet position justifies the hope of a special bonus of some kind whenever this course is considered opportune by the directors. Sangers were steady at 25s. 6d. on anticipations that the dividend will be unchanged despite the larger capital in issue, and Timothy Whites and Taylors were steady at 31s. 3d. British Drug Houses were again around 22s. British Industrial Plastics remained at 2s. 10½d.

General Refractories improved further from 27s. 6d. to 28s. 6d., but Turner and Newall were reactionary and at 97s. 6d. have lost 1s. 3d. Associated Portland Cement have also moved to a lower figure and are 96s. 9d. at the time of writing at which an apparently attractive yield is offered on the basis of last year's increased dividend of 22½ per cent. British Portland Cement and other shares of companies connected with the building trades were also reactionary, although, according to some market views, fears of any early large decline in building activity are much exaggerated. British Plaster Board were also lower at 40s. Wall Paper Manufacturers were firmer at 41s., having benefited from the recent announcement of the maintenance of the interim dividend.

Unilever were strong, largely owing to the good impression created by the statements at the recent meeting where reference was made to the proposed future simplification of the structure of the group. The market is also taking the view that Unilever will probably not be materially affected by the new N.D.C. tax. Lever Brothers preference shares were higher in price.

Fison, Packard and Prentice were again around 40s., and Cooper, McDougall and Robertson transferred at the rather better price of 36s. The shares of the latter company are held steadily in view of the company's favourable dividend record and strong balance sheet, while it is assumed that with further recovery in the Argentine and other agricultural countries there will be scope for considerable improvement in the company's earnings.

Goodlass Wall and Lead Industries made the higher price of 13s. 6d. on the increase in profits for the past year. As previously announced, the distribution on the shares is raised by 1 per cent. to 7 per cent., and the latter proves to be a conservative payment. Pinchin Johnson were steady and other paint shares little changed.

Richard Thomas, Dorman Long, Consett Iron and most other iron, steel and allied shares held the greater part of their recent improvement. Oil shares were moderately reactionary, but this was attributed to general market conditions and not to any confident hopes regarding the forthcoming dividends.

Weekly Prices of British Chemical Products

THE only price changes reported in the London heavy chemical market this week are in the rubber chemical section, where the price of cadmium sulphide has advanced by 2d. per lb., and in the coal tar products section, where toluol is 1d. per gal. dearer than a week ago. Among fine chemicals there has been an increase of 3d. per lb. on all prices for iodides owing to the increased cost of packing materials. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

MANCHESTER.—Buying interest in chemicals on the Manchester market during the past week has shown some indications of slowing down and this seasonal contraction is expected to continue until after next week. There has, however, been little sign of any falling away in the rate at which materials are being taken up against contracts, although with consuming works closed in the district during part of next week quieter conditions are looked for for the time being. The market as a whole remains steady and few changes of any consequence have occurred since the last report. Among the by-products cresylic acid and pyridine are

extremely firm and crude carbolic acid has further stiffened in price to some extent as a result of the advance in crystals. Most descriptions of by-products are meeting with a steady demand on this market.

GLASGOW.—Business in chemicals has been rather quiet during the week, both for home trade and export. Prices, however, continue steady at about previous figures, the general undertone continuing very firm. Trading in coal tar products slackened somewhat during the week on account of the national holiday. A generally firm tone prevails, however, almost without exception throughout the by-products group, with cresylic acid the brightest feature and pitch at the other end of the scale. Fresh business has been booked in motor benzol, the demand for which is stronger on account of prevailing petrol values. The demand for creosote exceeds present available supplies and latest quotations show a further advance of ½d. per gallon. Pyridine is rather difficult to secure and any available supplies are commanding a price which fully maintains the current level indicated.

General Chemicals

ACETONE.—£45 to £47 per ton.
ACID, ACETIC.—Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £30 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.
ACID, BORIC.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.
ACID, CHROMIC.—9½d. per lb., less 2½%; d/d U.K.
ACID, CITRIC.—1s. per lb. MANCHESTER: 1s. SCOTLAND: B.P. crystals, 1s. per lb., less 5%, ex store.
ACID, FORMIC.—85%, in carboys, ton lots, £42 to £47 per ton.
ACID, HYDROCHLORIC.—Spot, 5s. to 7s. 6d. carboy d/d according to purity, strength and locality.
ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.
ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works.
ACID, OXALIC.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £55 per ton ex store.
ACID, SULPHURIC.—168° Tw., £4 5s. to £4 15s. per ton; 140° Tw., arsenic-free, £2 15s. to £3 5s.; 140° Tw., arsenious, £2 10s.
ACID, TARTARIC.—1s. 1½d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 1½d. per lb.
ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.
ALUMINIUM SULPHATE.—£7 per ton d/d Lancs.; GLASGOW: £7 to £8 ex store.
AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.
AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.
AMMONIUM BICHRIMATE.—8d. per lb. d/d U.K.
AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.
AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £16 10s. (See also Sal ammoniac.)
AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Sal ammoniac.)
ANTIMONY OXIDE.—£55 10s. per ton.
ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £17 ex store. MANCHESTER: White powdered Cornish, £17, ex store.
BARIUM CHLORIDE.—£10 per ton. GLASGOW: £11 5s. per ton.
BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.
BLEACHING POWDER.—Spot, 35/37%, £8 15s. per ton in casks, special terms for contracts. SCOTLAND: £9 per ton net ex store.
BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16, crystal, £17; powdered, £17 10s. per ton in 1-cwt. bags, carriage paid.
CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. GLASGOW: 70/75% solid, £5 10s. per ton net ex store.
CHROMETAN.—Crystals, 2½d. per lb.; liquor, £19 10s. per ton d/d
CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. GLASGOW: 99%, £4 7s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£22 10s. per ton.
GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £5 7s. 6d. to £6 7s. 6d. per cwt. according to quantity; in drums, £5 to £5 13s. 6d.
IODINE.—Resublimed B.P., 5s. 1d. per lb.
LEAD ACETATE.—LONDON: White, £35 10s. per ton; brown, £35.
GLASGOW: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £36; brown, £35 10s.
LEAD NITRATE.—£39 per ton.
LEAD, RED.—SCOTLAND: £37 per ton, less 2½%, carriage paid for 2-ton lots.
LEAD (WHITE SUGAR OF).—GLASGOW: £37 10s. per ton net, ex store.
LITHARGE.—SCOTLAND: Ground, £37 per ton, less 2½%, carriage paid for 2-ton lots.
MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.
MAGNESIUM CHLORIDE.—SCOTLAND: £7 10s. per ton.
MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.
MERCURY.—Ammoniated B.P. (white precip.), lump, 5s. 11d. per lb.; powder B.P., 6s. 1d.; bichloride B.P. (corros. sub.) 5s. 2d.; powder B.P. 4s. 10d.; chloride B.P. (calomel), 5s. 11d.; red oxide cryst. (red precip.), 7s.; levig. 6s. 6d.; yellow oxide B.P. 6s. 4d.; persulphate white B.P.C., 6s. 1d.; sulphide black (hyd. sulph. cum sulph. 50%), 6s. For quantities under 112 lb., 1d. extra.
METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.
PARAFFIN WAX.—SCOTLAND: 3½d. per lb.
PHENOL.—6½d. to 7½d. per lb.
POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £40.
POTASSIUM BICHRIMATE.—SCOTLAND: 5d. per lb., less 5%, carriage paid.
POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4½d. per lb. MANCHESTER: £37 10s. per ton.
POTASSIUM IODIDE.—B.P. 4s. 3d. per lb.
POTASSIUM NITRATE.—£27 per ton. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.
POTASSIUM PERMANGANATE.—LONDON: 9½d. per lb. SCOTLAND: B.P. Crystals, 9½d. MANCHESTER: B.P. 11d. to 1s.
POTASSIUM PRUSSATE.—6½d. per lb. SCOTLAND: 7d. net, in casks, ex store. MANCHESTER: Yellow, 6½d. to 7½d.
SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. GLASGOW: Large crystals, in casks, £38.
SALT CAKE.—Unground, spot, £3 16s. 6d. per ton.
SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.
SODA, CAUSTIC.—Solid, 76/77° spot, £12 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 76/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less.
SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
SODIUM ACETATE.—£18 per ton carriage paid North. GLASGOW: £18 10s. per ton net ex store.
SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. GLASGOW: £12 15s. per ton in 1 cwt. kegs, £11 per ton in 2-cwt. bags. MANCHESTER: £10 10s.
SODIUM BICHRIMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. MANCHESTER: 4d. per lb. GLASGOW: 4d., less 5% carriage paid.
SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.
SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags.

SODIUM CHLORATE.—£26 10s. to £30 per ton. GLASGOW: £1 10s. per cwt.
SODIUM CHROMATE.—4d. per lb. d/d U.K.
SODIUM HYPOSULPHATE.—Commercial, 2 ton lots d/d, £10 5s. per ton; photographic, £14 5s. MANCHESTER: Commercial, £10; photographic, £14 10s.
SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.
SODIUM NITRATE.—Refined, £7 15s. per ton for 6-ton lots d/d.
SODIUM NITRITE.—£18 5s. per ton for ton lots.
SODIUM PERBORATE.—10%, 9½d. per lb. d/d in 1-cwt. drums.
SODIUM PHOSPHATE.—£13 per ton.
SODIUM PRUSSIAN.—4d. per lb. for ton lots. GLASGOW: 5d. to 5½d. ex store. MANCHESTER: 4½d. to 4¾d.
SODIUM SILICATE.—£9 10s. per ton.
SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.
SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 10s.
SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 5s. per ton d/d in drums; crystals 30/32%, £8 15s. per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.
SODIUM SULPHITE.—Pea crystals, spot, £13 5s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.
SULPHATE OF COPPER.—£20 per ton, less 2%, in casks. MANCHESTER: £22 per ton f.o.b. SCOTLAND: £24 10s. per ton less 5%, Liverpool, in casks.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb., according to quality. Crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.
ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.
BARYTES.—£6 to £7 10s. per ton, according to quality.
CADMIUM SULPHIDE.—7s. 2d. to 7s. 5d. per lb.
CARBON BISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.
CARBON BLACK.—3 11/16d. to 4 13/16d. per lb., ex wharf.
CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.
CHROMIUM OXIDE.—Green, 1s. 2d. per lb.
DIPHENYLGUANIDINE.—2s. 2d. per lb.
INDIA-RUBBER SUBSTITUTES.—White, 4½d. to 5d. per lb.; dark, 3½d. to 4½d. per lb.
LAMP BLACK.—£22 to £23 per ton d/d London; vegetable black, £28 to £48.
LEAD HYPOSULPHITE.—9d. per lb.
LITHOPONE.—30%, £16 10s. to £17 5s. per ton.
SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.
SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.
VERMILION.—Pale, or deep, 5s. 3d. per lb., 1-cwt. lots.
ZINC SULPHIDE.—10d. to 11d. per lb., according to quality.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—Neutral quality, basis 20.6 per cent. nitrogen, delivered in 6-ton lots to farmer's nearest station, £7 5s. per ton.
CALCIUM CYANAMIDE.—£7 5s. per ton, carriage paid to any railway station in Great Britain in lots of four tons and over.
NITRO-CHALK.—£7 5s. per ton for delivery to end of June.
NITRATE OF SODA.—£7 12s. 6d. per ton for delivery up to end of June.
CONCENTRATED COMPLETE FERTILISERS.—£10 12s. to £11 1s. per ton delivered in 6-ton lots to farmer's nearest station.
AMMONIUM PHOSPHATE FERTILISERS.—£10 5s. to £13 15s. per ton for delivery up to end of June, delivered in 6-ton lots to farmer's nearest station.

Coal Tar Products

ACID, CRESYLIC.—97/99%, 4s. 11d. to 5s. per gal.; 99/100%, 4s. 11d. to 5s. 7d., according to specification; pale 99%, 5s. 1d. to 5s. 2d.; dark, 4s. 6d. to 4s. 8d. GLASGOW: Pale, 99/100%, 5s. to 5s. 6d. per gal.; pale 97/99%, 4s. 6d. to 4s. 10d., dark, 97/99%, 4s. to 4s. 3d.; high boiling acids, 2s. 4d. to 2s. 8d. American specification, 4s. to 4s. 6d. MANCHESTER: Pale, 99/100%, 5s.
ACID, CARBOLIC.—Crystals, 6½d. to 7½d. per lb.; crude, 60's, 3s. 5d. to 3s. 8d. per gal. MANCHESTER: Crystals, 8½d. per lb. f.o.b. in drums; crude, 3s. 9d. per gal. GLASGOW: Crude, 60's, 3s. 6d. to 3s. 8d. per gal.; distilled, 60's, 4s. 3d. to 4s. 6d.
BENZOL.—At works, crude, 10d. to 10½d. per gal.; standard motor, 1s. 3½d. to 1s. 4d.; 90%, 1s. 4½d. to 1s. 5d.; pure, 1s. 8½d. to 1s. 9d. GLASGOW: Crude, 10d. to 10½d. per gal.; motor, 1s. 5d. to 1s. 5½d.
CREOSOTE.—B.S.I. Specification standard, 6d. per gal. f.o.r. Home, 3½d. d/d. LONDON: 4½d. f.o.r. North: 5d. London. MANCHESTER: 5½d. to 6½d. GLASGOW: B.S.I. Specification, 6d. to 6½d. per gal.; washed oil, 5½d. to 5½d.; lower sq. gr. oils, 5½d. to 5½d.
NAPHTHA.—Solvent, 90/160%, 1s. 7d. to 1s. 8d. per gal.; 95/160%, 1s. 8d. to 1s. 9d.; 90/190%, 1s. 2d. to 1s. 3d.

LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. GLASGOW: Crude, 6d. to 6½d. per gal.; 90% 160, 1s. 6½d. to 1s. 7½d., 90% 190, 1s. 1d. to 1s. 2d.
NAPHTHALENE.—Crude, whizzed or hot pressed, £11 10s. to £12 10s. per ton; purified crystals, £18 to £20 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. GLASGOW: Fire lighter, crude, £6 to £7 per ton (bags free). MANCHESTER: Refined, £21 to £22 per ton f.o.b.
PYRIDINE.—90/140%, 9s. to 10s. per gal.; 90/180, 2s. 9d. to 3s. 6d. GLASGOW: 90% 140, 9s. to 10s. per gal.; 90% 160, 7s. to 8s.; 90% 180, 2s. 6d.
TOLUOLE.—90%, 2s. to 2s. 1d. per gal.; pure, 2s. 6d. GLASGOW: 90%, 120, 1s. 10d. to 1s. 11d. per gal.
PITCH.—Medium, soft, 36s. to 37s. per ton, in bulk at makers' works. MANCHESTER: 35s. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 32s. to 37s. per ton; in bulk for home trade, 32s. 6d.
XVLOL.—Commercial, 2s. 3d. per gal.; pure, 2s. 5d. GLASGOW: Commercial, 2s. to 2s. 1d. per gal.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 10s. to £9 per ton; grey, £10 10s. to £11 10s. Liqueur, brown, 30° Tw., 6d. to 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £11 10s.
CHARCOAL.—£5 15s. to £11 per ton, according to grade and locality.
METHYL ACETONE.—40-50%, £42 to £45 per ton.
WOOD CREOSOTE.—Unrefined 6d. to 1s. 6d. per gal., according to boiling range.
WOOD, NAPHTHA, MISCIBLE.—2s. 9d. to 3s. 3d. per gal.; solvent, 3s. 6d. to 3s. 9d. per gal.
WOOD TAR.—£2 10s. to £4 per ton.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex toluol).—1s. 9½d. per lb. d/d buyer's works.
ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.
ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
ACID NAPHTHIONIC.—1s. 8d. per lb.
ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.
ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.
ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZIDINE, HCl.—2s. 5d. per lb., 100% as base, in casks.
m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.
p-CRESOL 34-5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.
DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.
DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.
DINITROBENZENE.—7½d. per lb.
DINITROCHLOROBENZENE, SOLID.—£72 per ton.
DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 10d.
DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.
α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-NAPHTHOL.—9½d. to 9½d. per lb.; flake, 9½d. to 9½d.
α-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d. in casks.
β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works in casks.
o-NITRANILINE.—3s. 11d. per lb.
m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 8d. to 2s. 1d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.
NITRONAPHTHALENE.—9d. per lb.: P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb., 100% d/d buyer's works.
o-TOLUIDINE.—10½d. per lb., in 8/10-cwt. drums, drums extra.
p-TOLUIDINE.—1s. 10½d. per lb., in casks.
m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Latest Oil Prices

LONDON, May 11.—LINSEED OIL was easy. Spot, £31 15s. per ton (small quantities); May, £29 7s. 6d.; July-Aug. and Sept.-Dec., £29 10s.; Jan.-April, £29 12s. 6d., naked. SOYA BEAN OIL was inactive. Oriental (bulk), afloat Rotterdam, £25 per ton. RAPE OIL was idle. Crude extracted, £36 per ton; technical, refined, £37, naked, ex wharf. COTTON OIL was quiet. Egyptian crude, £30 per ton; refined common edible, £34; deodorised, £36, naked, mill (small lots £1 10s. extra). TURPENTINE was easy: American, spot, 39s. 9d. per cwt.
 HULL.—LINSEED OIL.—Spot quoted £30 per ton; May, June-Aug., and Sept.-Dec., £29 10s. COTTON OIL.—Egyptian, crude, spot, £30 10s.; edible, refined, spot, £33 10s.; technical, spot, £33 10s.; deodorised, £35 10s., naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £27 10s., naked. GROUNDNUT OIL.—Extracted, spot, £31 10s.; deodorised, £34 10s. RAPE OIL.—Extracted, spot, £35; refined, £36. SOYA OIL.—Extracted, spot, £33 10s.; deodorised, £36 10s. per ton. COD OIL.—F.o.r. or f.a.s., 27s. 6d. per cwt. in barrels. CASTOR OIL.—Pharmaceutical, 45s.; first, 40s.; second, 38s. TURPENTINE.—American, spot, 40s. 9d. per cwt.

Forthcoming Events

LONDON.

May 19.—Institution of Chemical Engineers. "Platinum and Allied Metals." Major C. Johnson and Capt. R. H. Atkinson. 6 p.m. Burlington House.

May 19.—Society of Chemical Industry (Food Group). Annual general meeting. Dr. Franklyn Kidd. 8 p.m. London School of Hygiene and Tropical Medicine.

May 20.—The Chemical Society. Ordinary scientific meeting. Discussion: "Synthesis and Stereochemistry of Condensed Alicyclic Systems." Dr. R. P. Linstead. 8 p.m. Burlington House.

NEWCASTLE.

May 21.—The Chemical Society. (Newcastle-upon-Tyne and North-East Coast Section). 38th Bedson Lecture. "The Chemistry of Food Production." Sir E. John Russell. 6.30 p.m. Chemistry Lecture Theatre. Armstrong College.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

CELLULOSE COMPOSITIONS CO., LTD., Trumpington. (M., 15/5/37.) April 27. £2,000 debenture, to Branch Nominees, Ltd.; general charge. *Nil. January 4, 1937.

TRENAS, LTD., Tenterden, metal merchants. (M., 15/5/37.) April 29, mortgage to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on land and buildings at Ashford Road, Tenterden. *Nil. Dec. 31, 1935.

LAWRENCE AND MAYO, LTD., London, W.C., manufacturers of scientific instruments, etc. (M., 15/5/37.) April 29, series of £1,000 debentures, present issue £50; general charge. *£2,200. March 10, 1936.

LYDNEY GAS LIGHT AND COKE CO., LTD. (M., 15/5/37.) April 28, debenture to Lloyds Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. April 5, 1937.

PERMASTIC, LTD., Addlestone, manufacturers of plastic materials. (M., 15/5/37.) May 3, £9,000 charge, to Baron Roundway; general charge. *Nil. January 14, 1937.

PEARSONS (PONTEFRAC), LTD., glass bottle mould manufacturers, etc. (M., 15/5/37.) April 27, charge, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; charged on land and buildings at Pontefract. *Nil. December 31, 1935.

Receiverships

GRANGER CHEMICAL PROCESSES, LTD., Loates Lane, Watford, Herts.—Mr. Joseph A. Gillett, of 24 Livery Street, Birmingham, was appointed receiver on May 3, 1937, under powers contained in debentures dated February 18, 1936.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

South Africa.—H.M. Trade Commissioner at Johannesburg reports that the General Hospital at Johannesburg is calling for tenders, to be presented in Johannesburg by July 12, 1937, for the supply, delivery and erection of steam-raising plant. (Ref. T.Y. 2550.)

Company News

Titanine.—A final dividend on the ordinary shares of 10 per cent., actual, less tax, making with the interim 17½ per cent. actual for the ten months ended March 31 last, is announced. This is at the rate of 21 per cent. per annum.

British Alkaloids.—Final dividends are announced in respect of year ended March 31, of 13.12 per cent. on 8 per cent. participating preference shares, making 19.12 per cent., less tax, and 21 per cent. on ordinary shares, making 30 per cent., less tax.

British Borneo Petroleum Syndicate.—A net profit of £68,590 in the year to March 31 last, compared with £71,597 in the previous year is announced. The final dividend of 5 per cent., and bonus of 7½ per cent., less tax at 3s. 6.826d., make 17½ per cent.—the same rate as for 1935-36. The amount placed to general reserve is again £20,000, raising it to £70,000, and there is carried forward £44,758, against £42,106 brought in. Meeting, May 27.

Goodlass Wall and Lead Industries.—Profits increased by £26,076 to the record level of £275,082 in 1936. A net profit of £67,808 on the sale of special lead stocks has been transferred to reserve. In addition, £25,000 is transferred to reserve from profit and loss, raising this fund to £142,808. Staff pensions reserve receives £7,500, against £5,000. The distribution on the £1,204,678 ordinary capital is raised by 1 per cent., to 7 per cent., leaving the carry forward up from £74,484 to £78,661. Meeting, May 19.

Greeff-Chemicals Holdings.—The report to December 31, 1936, shows profit for period June 5, 1936 (date of incorporation) to December 31, 1936, amount to £16,422; deduct provision for tax, £1,012; preference dividends (gross) paid for period ended September 30, 1936, £2,072; provision for amount accrued to December 31, 1936, £1,718; leaving available balance of £11,618; payment of first and final dividend of 6½ per cent. actual, less tax, on ordinary for period (representing dividend at rate of 11.72 per cent. per annum), absorbing £8,125; forward £3,493. A resolution to convert ordinary and preference share capital into stock will be submitted at annual meeting. Meeting, May 19.

New Companies Registered

Grosvenor Utilities, Ltd.—Registered April 17. Nominal capital £100. Manufacturing and analytical chemists and chemical engineers, etc. Subscribers: V. H. Baker, 12 Longley Road, S.W.17, and J. C. Sturton.

J. C. Symonds, Ltd., 100 Albert Road, Caversham, Reading.—Registered March 12. Nominal capital £1,000. Manufacturers of and dealers in the products and processes for the refinement and treatment of metals and metal alloys, etc. Directors: John C. Symonds and G. Symonds.

Kingston Chemicals, Ltd., 121 Clarendon Street, Hull.—Registered May 5. Nominal capital £5,000. Manufacturers of and dealers in chemical gases, drugs, medicines, etc. Directors: Wm. G. Hill, John A. Hill, Hugh D. Cameron, and Herman Raymond.

Turtle Oil Preparations, Ltd., 34 Paternoster Row, E.C.4.—Registered April 17. Nominal capital £100 in 1,000 shares of 2s. each. Manufacturers of soaps, creams, toilet preparations, perfumes, patent medicines, proprietary articles, drugs, chemical preparations, etc. Directors: F. C. Thomas and H. H. Coffin.

Wharton Research Laboratories, Ltd., 25 Castle Street, Liverpool.—Registered April 30. Nominal capital, £250. To adopt an agreement with Arthur W. Greenwood and to carry on, develop and turn to account the apparatus, processes and serum mentioned therein; and to carry on business as chemists, druggists, chemical manufacturers and dealers, etc. Directors: Wm. E. Ford, W. B. Ward and Arthur Greenwood.

Books Received

The Electrochemistry of Solutions. By S. Glasstone. London: Methuen and Co., Ltd. Pp. 551. 25s.

The Mineral Position of the British Empire. London: Imperial Institute. Pp. 166. 4s.

Strontium Metals. By E. H. Beard. Second edition. London: Imperial Institute. Pp. 36. 1s. 6d.

Taschenbuch für die Farben- und Lackindustrie. By Erich Stock. Wissenschaftliche Verlagsgesellschaft m.b.H. Stuttgart. Pp. 556.

Organic Syntheses. Vol. 17. Edited by L. F. Fieser. New York: John Wiley & Sons. London: Chapman & Hall. Pp. 112. 8s. 6d.

